FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 110
No. 2317

MAY 4, 1961

Registered at the G.P.O. as a Newspaper *Offices: John Adam House, John Adam St., London, W.C.2*

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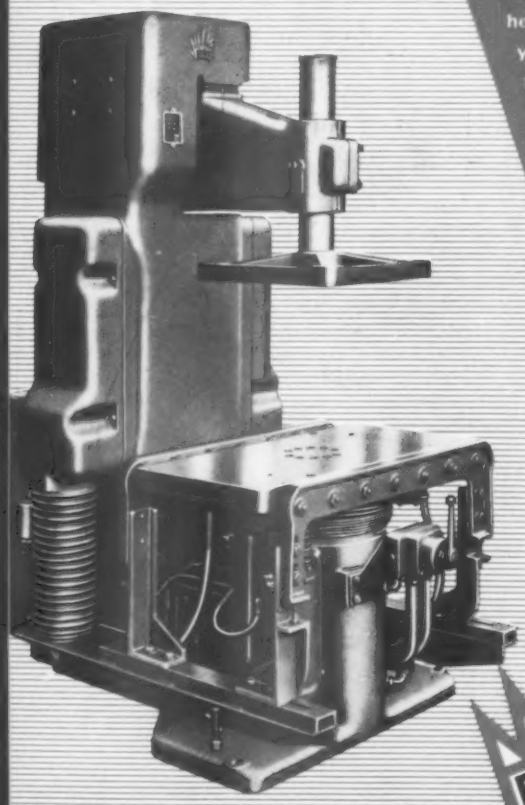

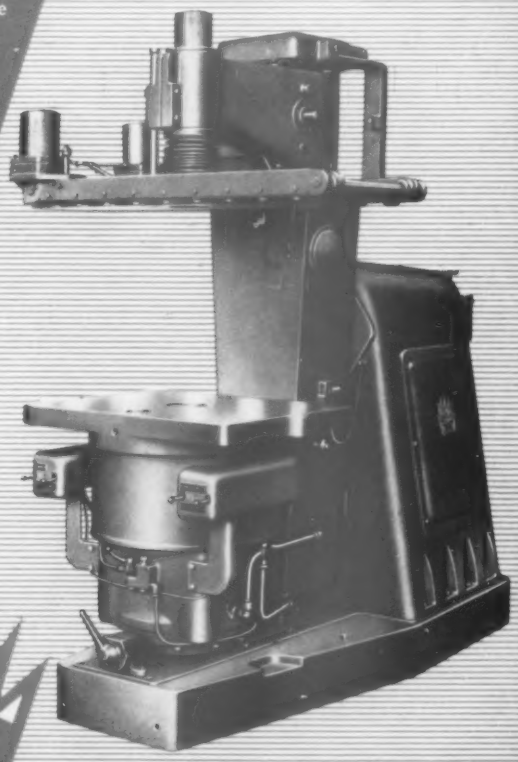

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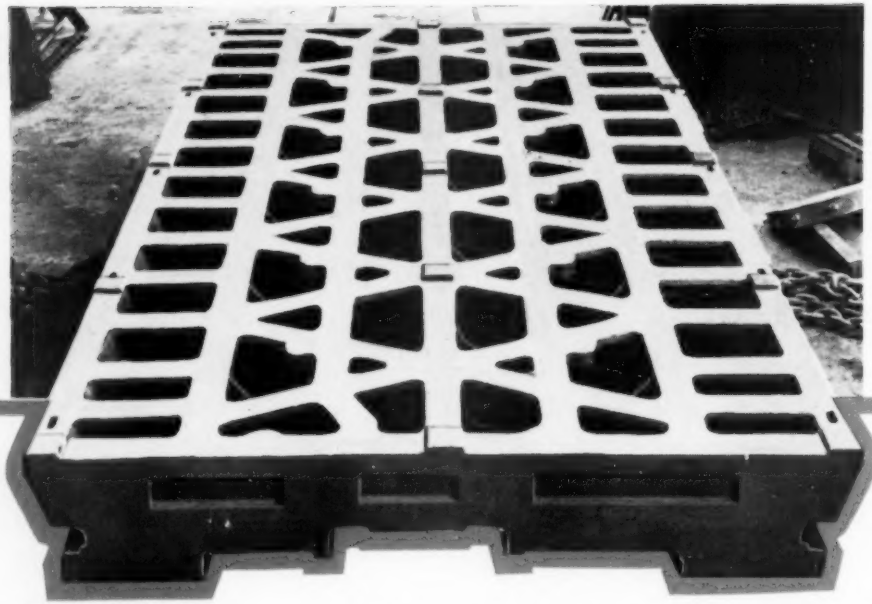

COROVIT SLASHES COREMAKING COSTS

at George Richards' Foundry

The coremaking time for the above 14 ton bed casting (19′ x 9½′ x 1¾′) for a horizontal boring machine was cut from 300 hours to 129 hours by using the Corovit cold setting technique. Further savings were made in decoring and fettling times, because Corovit cores reproduce accurately the dimensions of the corebox. And, of course, Corovit gives an improved finish, substantially reducing subsequent machining.

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ASK FORDATH TO TELL YOU ABOUT COROVIT COLD-SETTING TECHNIQUE

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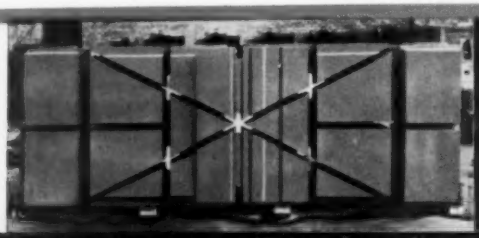
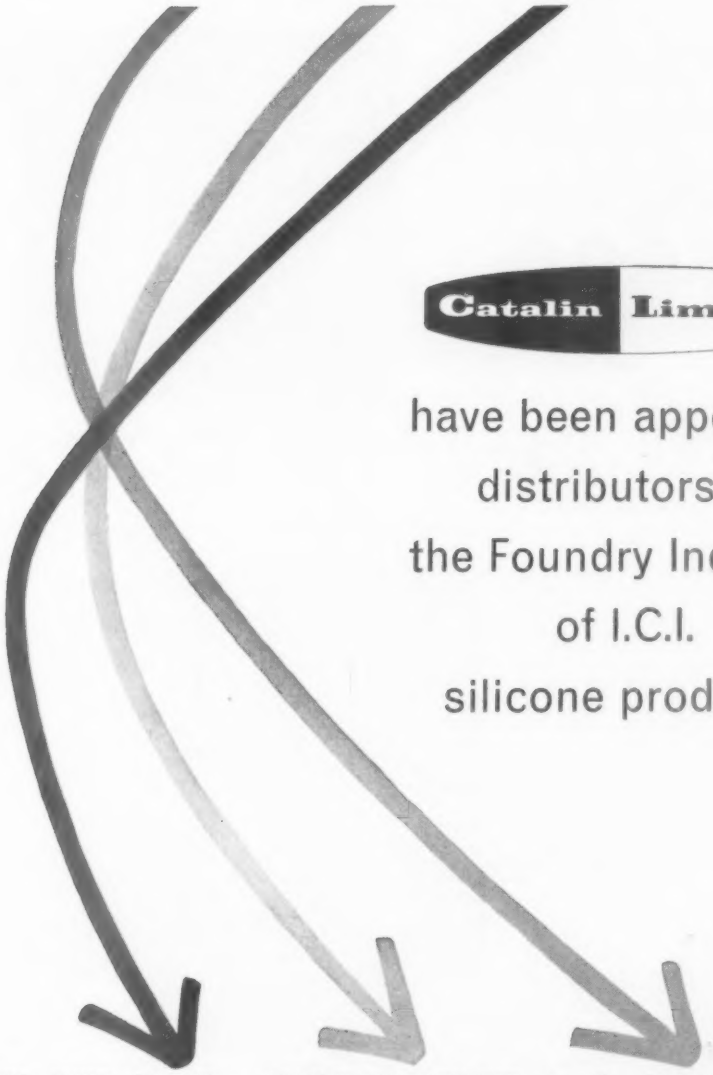


Above: One of the six 30 cwt. cores used in making the 14 ton casting. Each core measured 8′ x 3′ x 1¼′.

Above: Unstoved cold-set Corovit cores being lifted from the corebox in the green state.

THE FORDATH ENGINEERING COMPANY LIMITED, BRANDON WAY, WEST BROMWICH, STAFFS, ENGLAND.
Telephone: West Bromwich 1665. Telegrams: Fordath Telex West Bromwich. Telex No.: 33415



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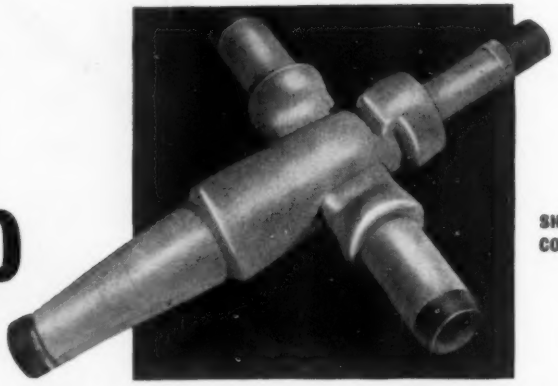

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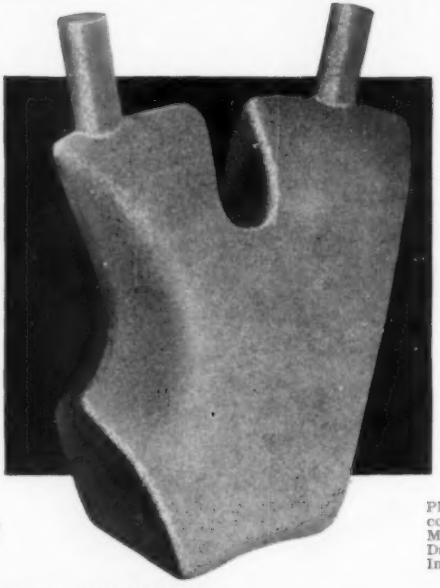

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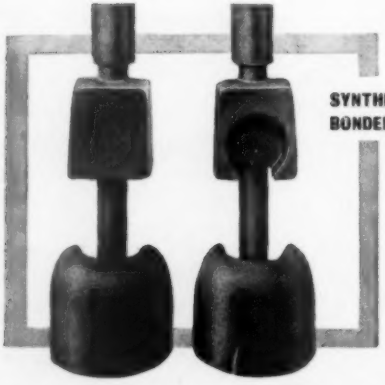

SYNTHETICALLY BONDED CORE

Photographs by courtesy of Messrs. David Brown Industries Ltd.

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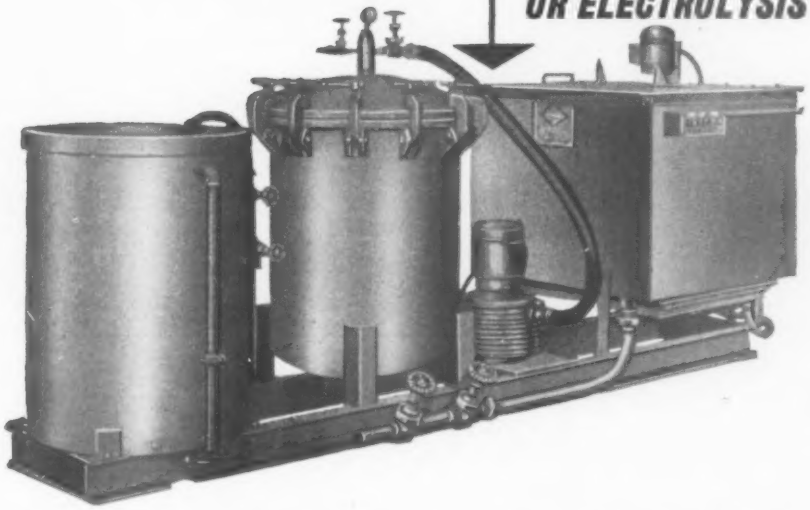

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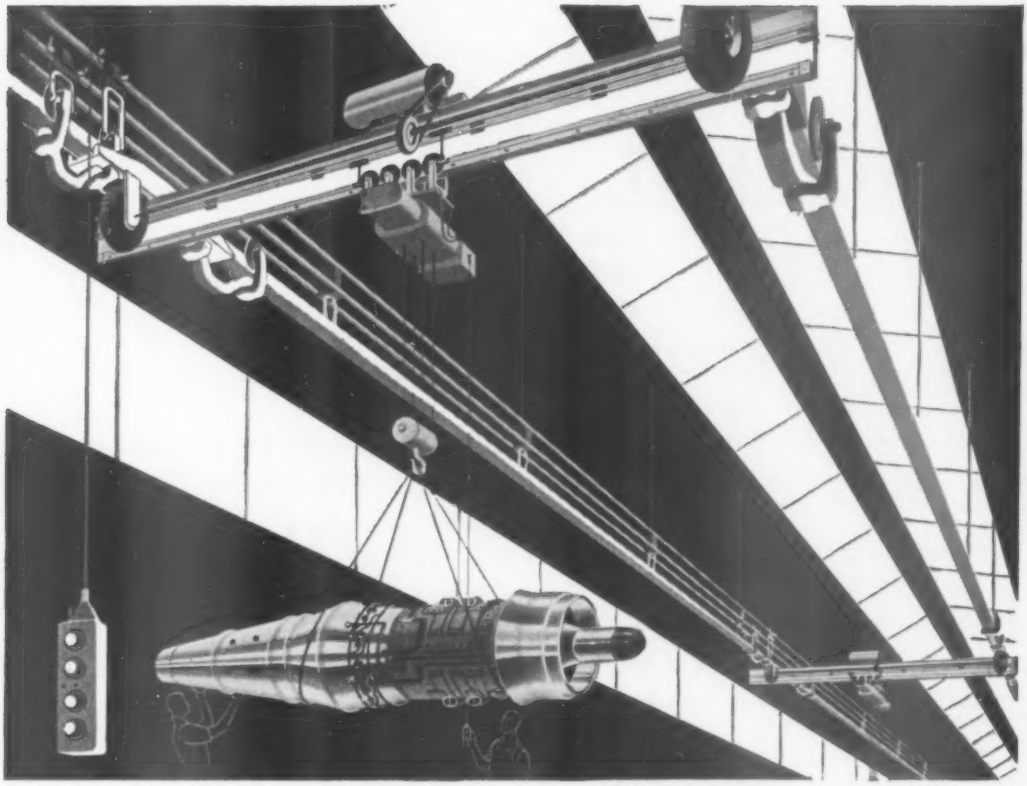

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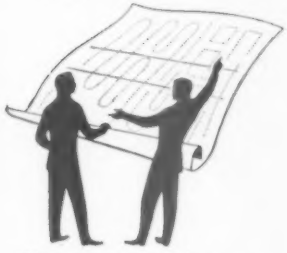

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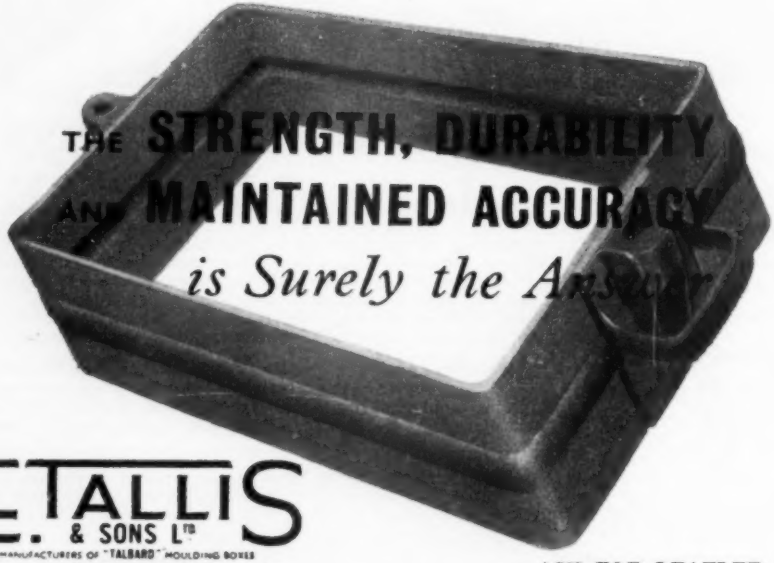

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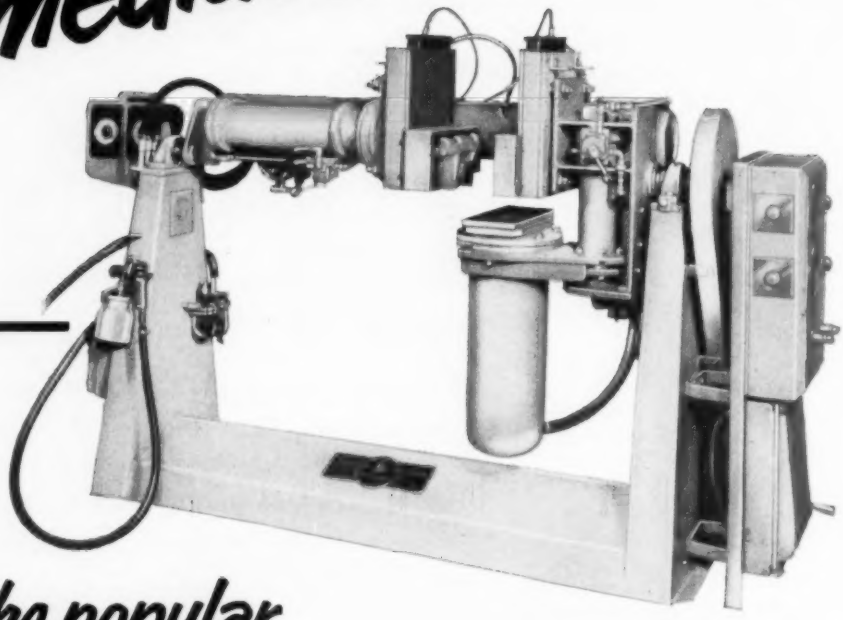

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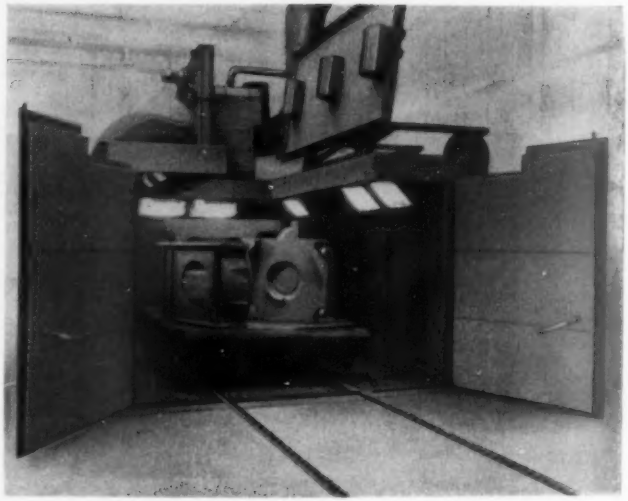

The waste sand is conveyed to a Sand Disposal Hopper, which is illustrated on the left, with a lorry in position to receive the waste sand load. Also illustrated is the latest Tilghman 'T' type filter tube dust collector, designed for high efficiency operation. For further details send for leaflet No. T.12R.

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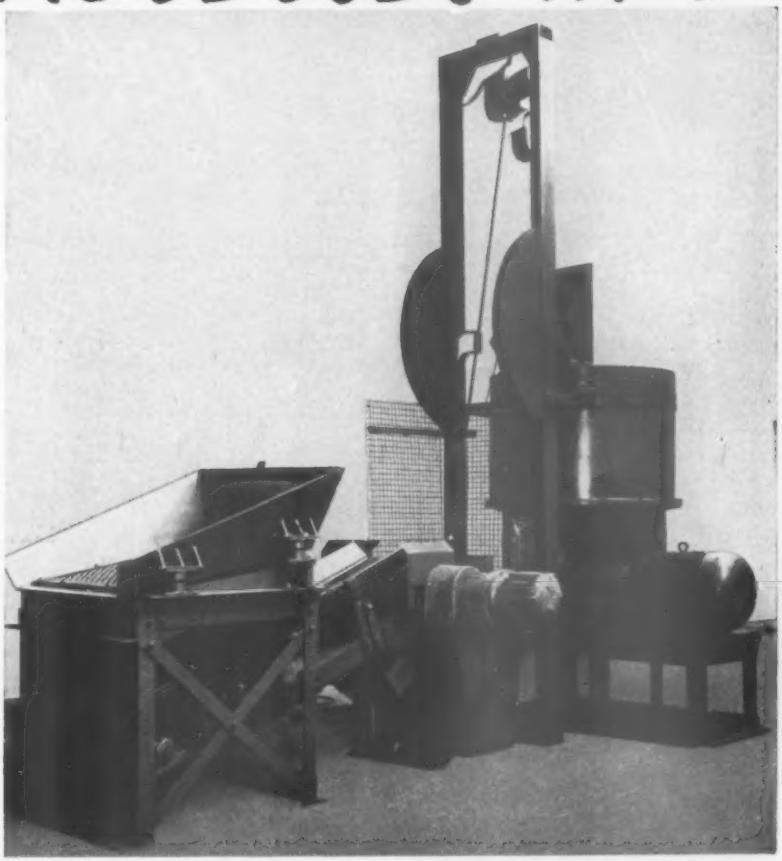

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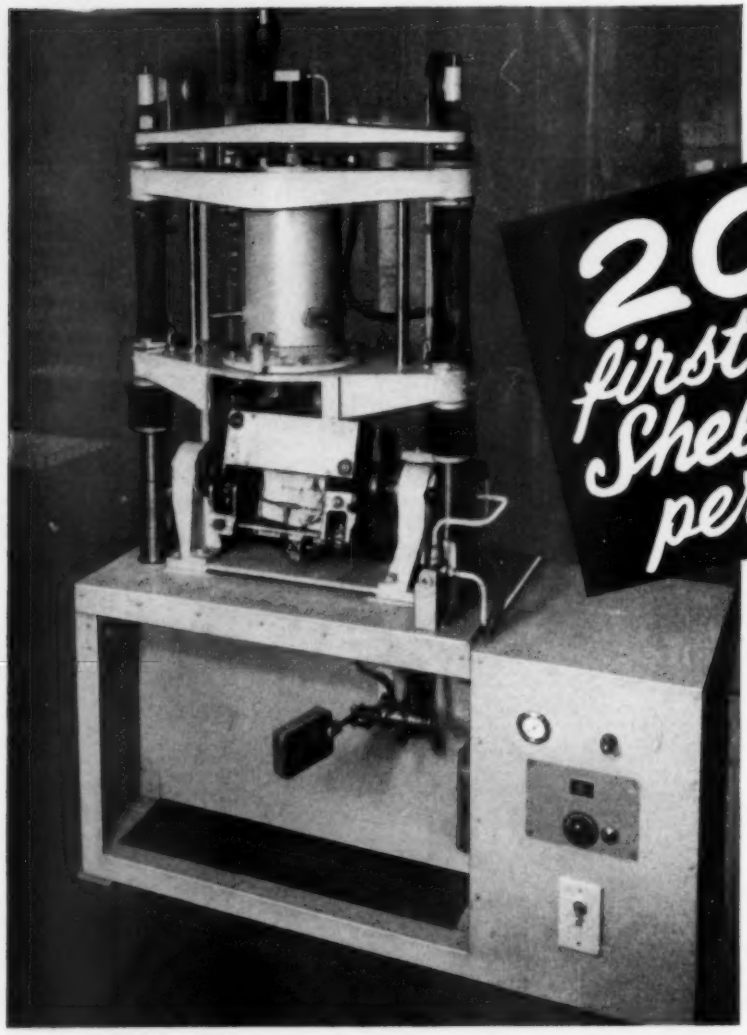

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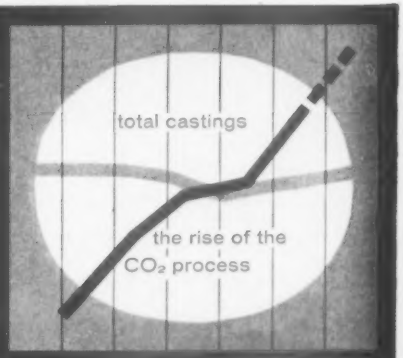

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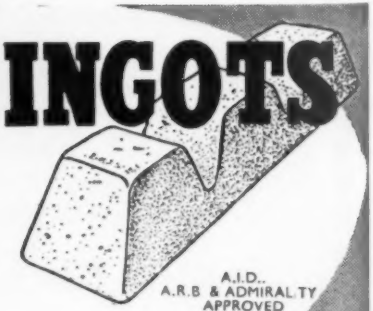

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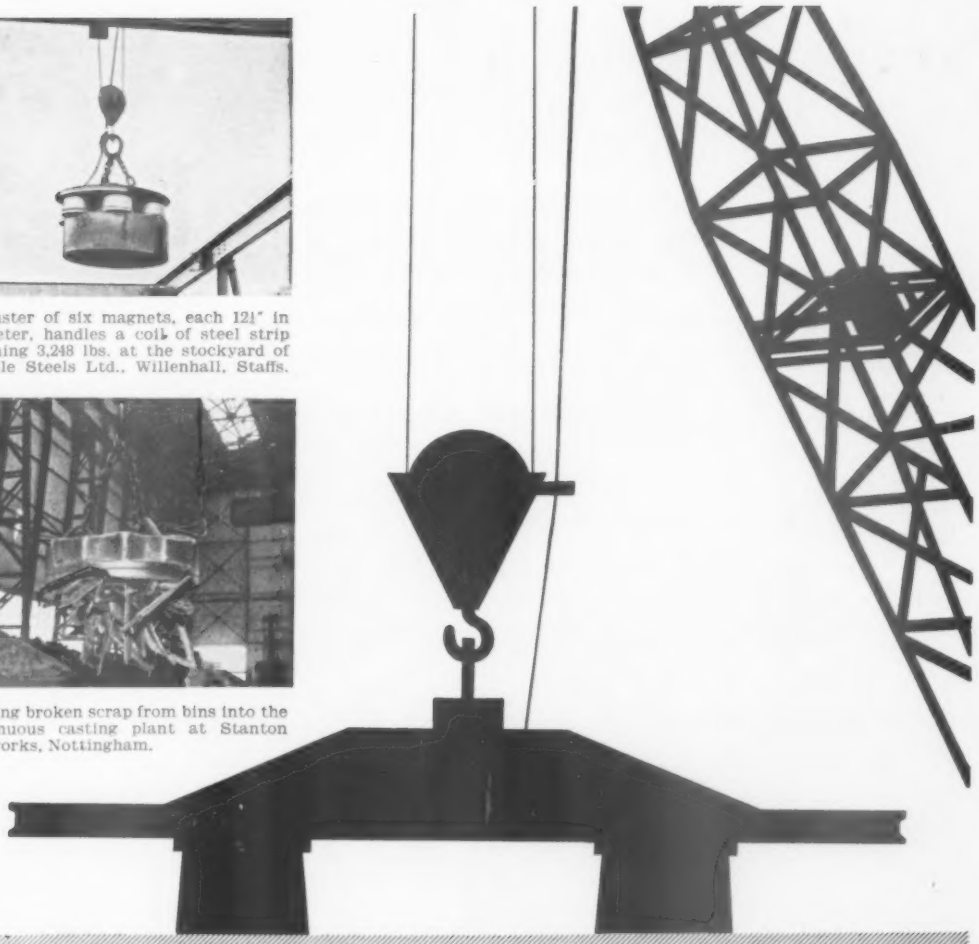
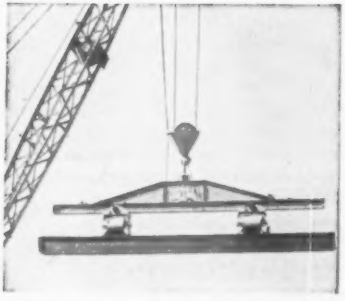
A cluster of six magnets, each 12½" in diameter, handles a coil of steel strip weighing 3,248 lbs. at the stockyard of Ductile Steels Ltd., Willenhall, Staffs.

Loading broken scrap from bins into the continuous casting plant at Stanton Ironworks, Nottingham.



WITTON-KRAMER LIFTING MAGNETS FOR EVERY JOB



Two bi-polar magnets on spreader beam lifting rolled steel joist.

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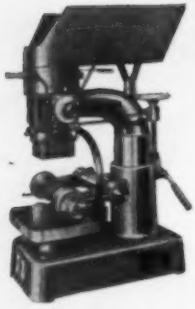

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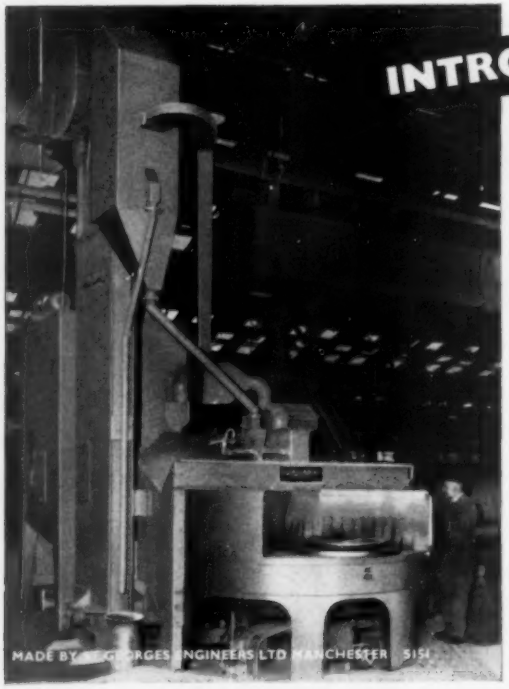

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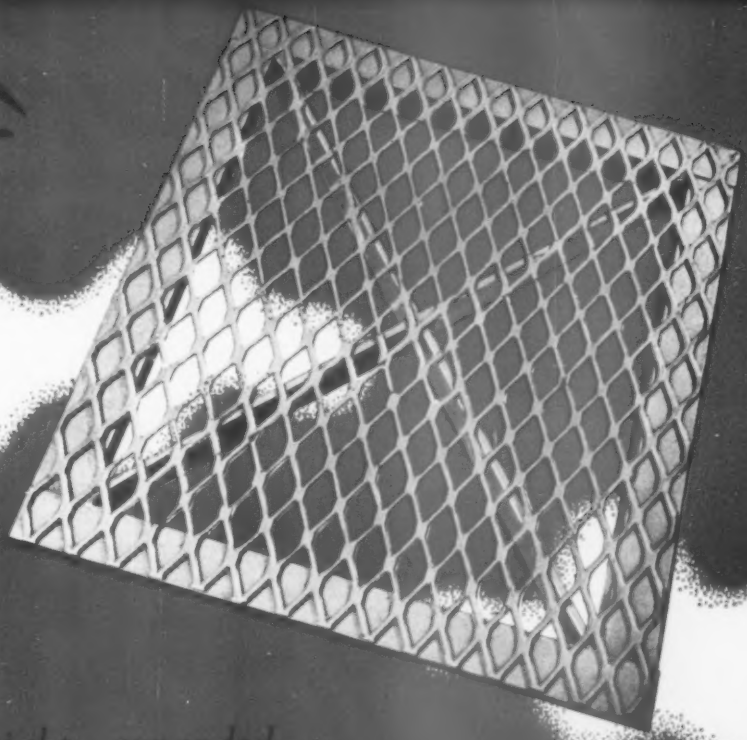

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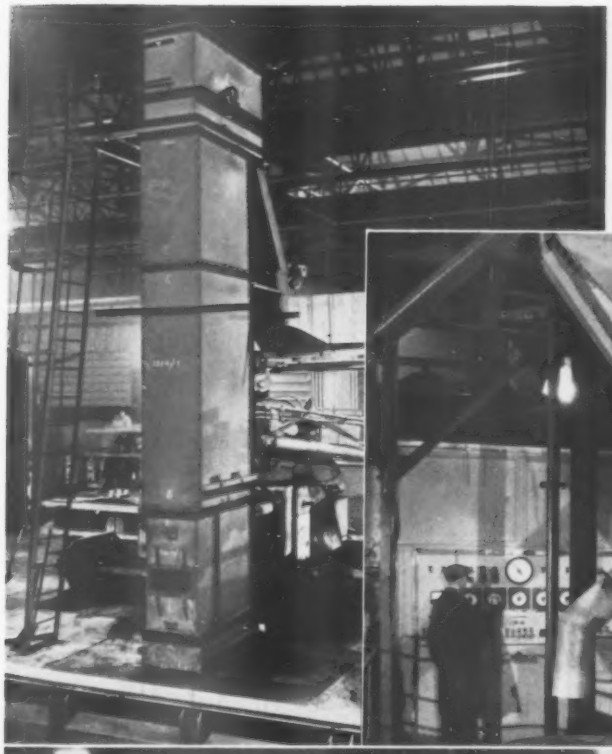

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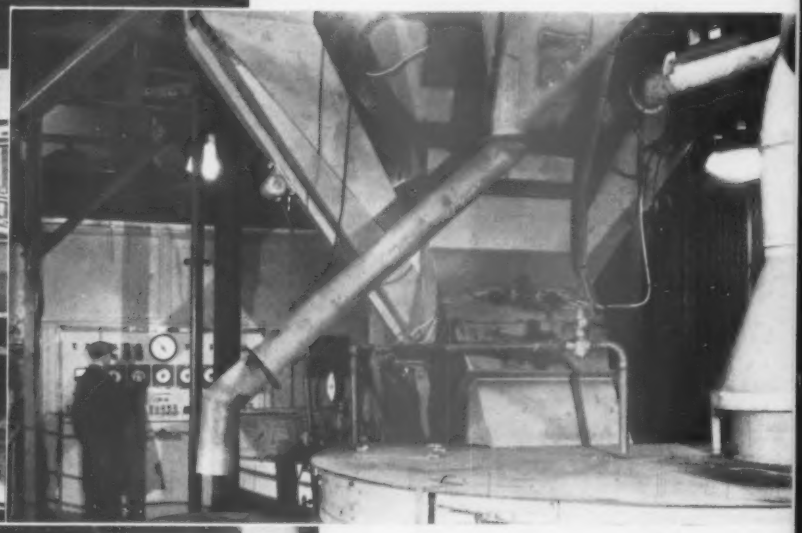

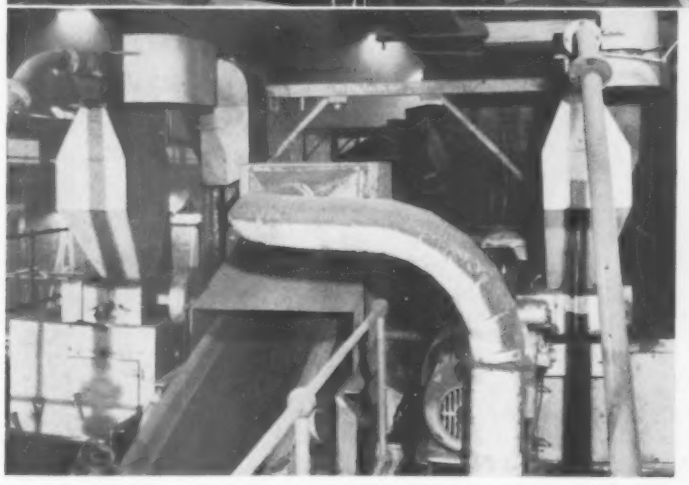

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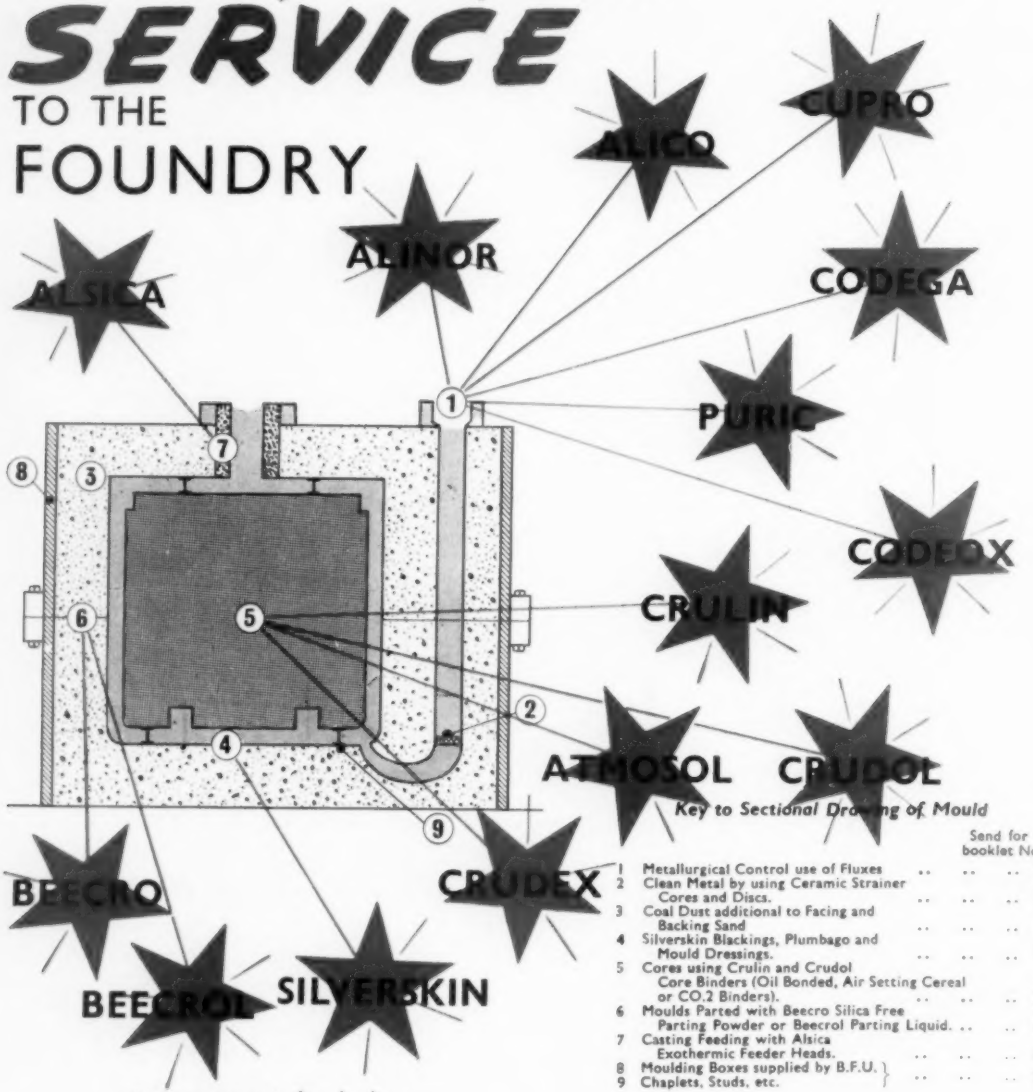

Key to Sectional Drawing of Mould

		Send for booklet No
1	Metallurgical Control use of Fluxes	3
2	Clean Metal by using Ceramic Strainer Cores and Discs.	4
3	Coal Dust additional to Facing and Backing Sand	1
4	Silverskin Blackings, Plumbago and Mould Dressings.	1
5	Cores using Crulin and Crudol Core Binders (Oil Bonded, Air Setting Cereal or CO.2 Binders).	2
6	Moulds Parted with Beecro Silica Free Parting Powder or Beecrol Parting Liquid.	1
7	Casting Feeding with Alsica Exothermic Feeder Heads.	4
8	Moulding Boxes supplied by B.F.U. }	5
9	Chaplets, Studs, etc. }	

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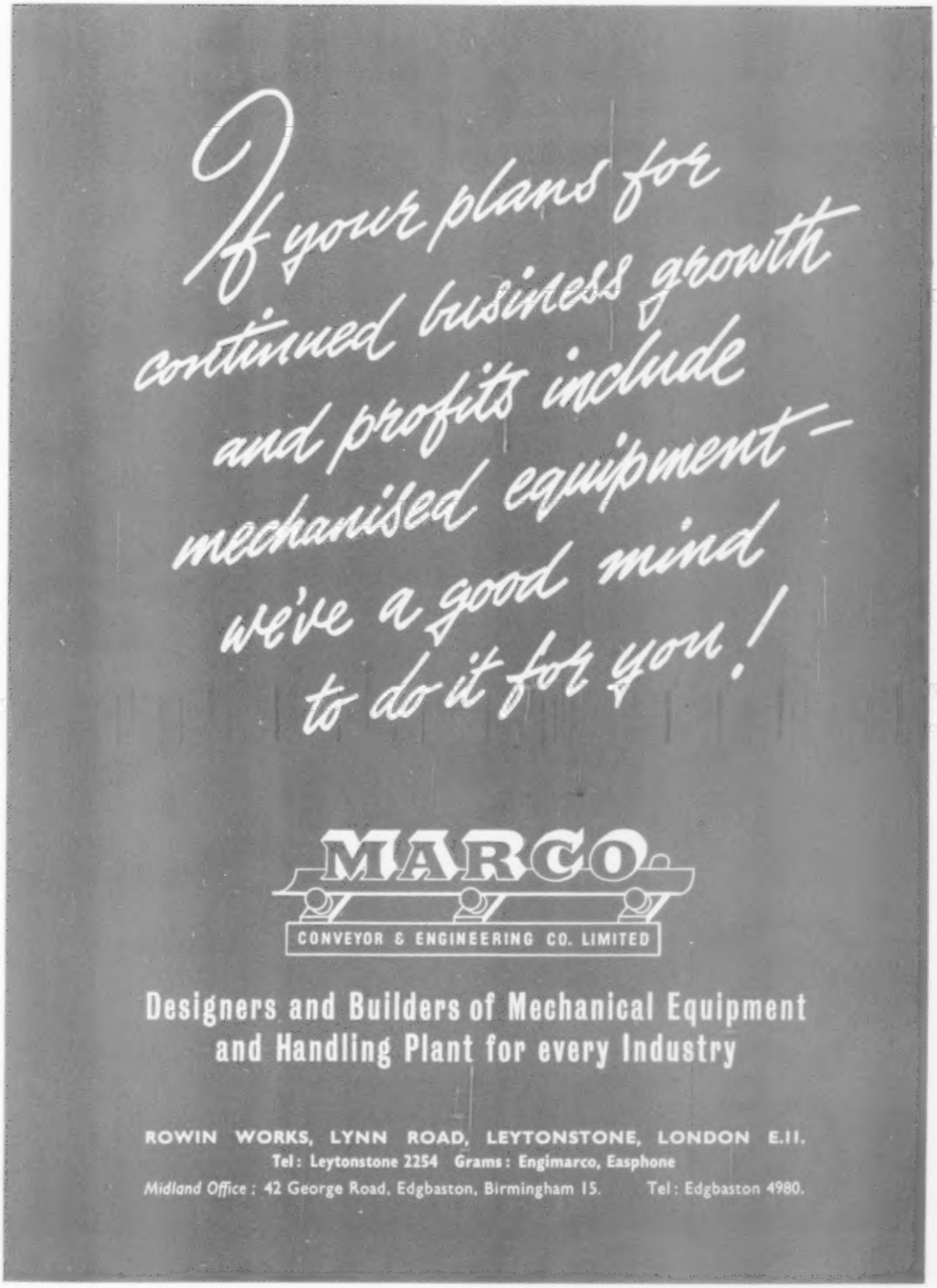
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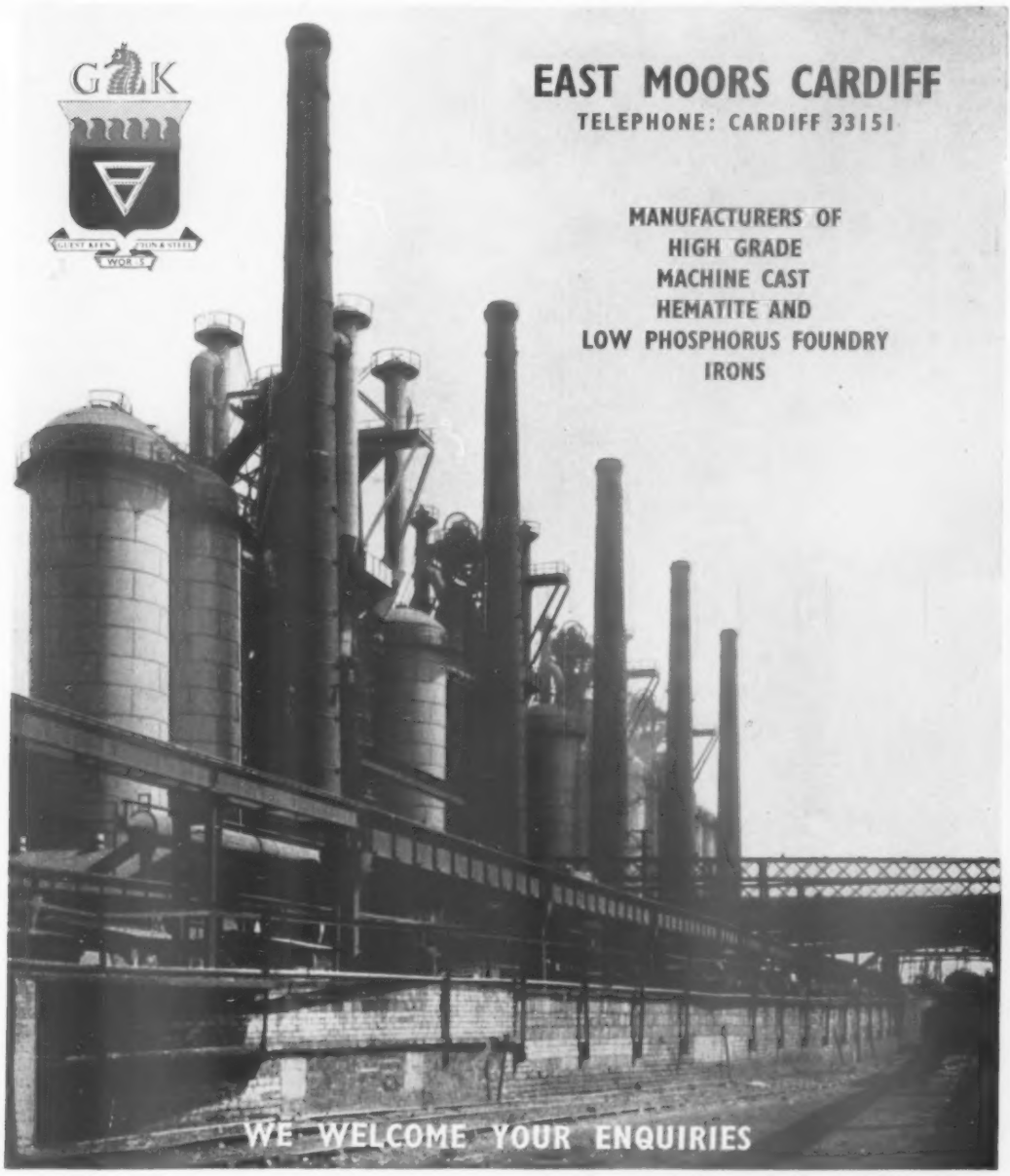

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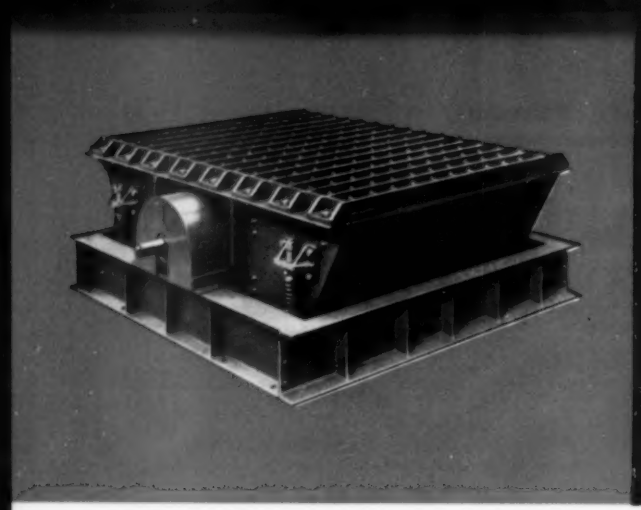

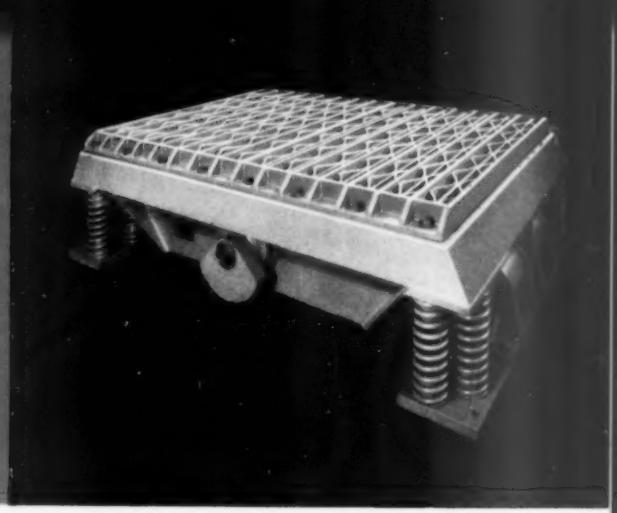

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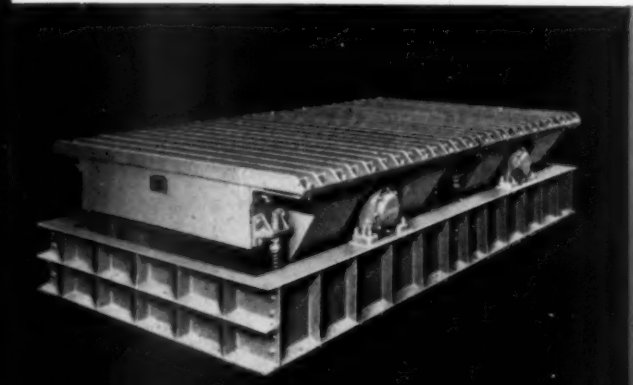

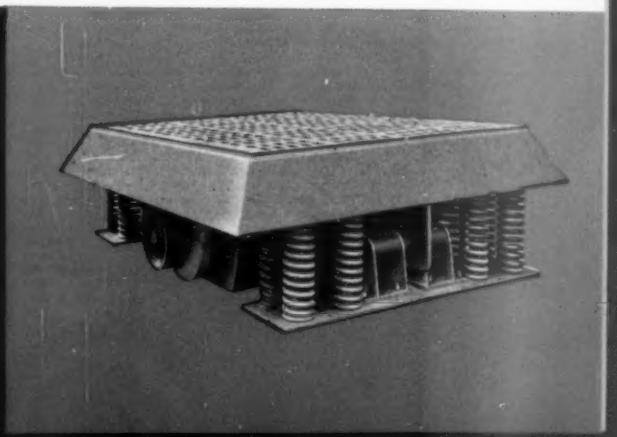

FOUNDRY TRADE JOURNAL

Vol. 110 May 4, 1961 No. 2317

Established 1902

Incorporating

IRON & STEEL TRADES JOURNAL

Published each Thursday

Annual subscription: United Kingdom 52s.
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PAGE

West of England Works Visits

Accounts of firms to be visited on May 17 as part of the IBF Cheltenham Conference proceedings 555

Production of Sound Grey-iron Castings

By I. C. H. Hughes, M.Sc., A.I.M.

Concluding section of a survey of recent research into the little-understood problem of achieving soundness in grey-iron castings .. 563

Particle Coating of Investment Moulds

The theory and practice of gas fluidization technique as applied to the coating of investment-mould patterns 569

Visites d'usines dans l'ouest de l'Angleterre.
Liste des entreprises qui seront visitées le 17 Mai en participation au programme de la conférence de l'Institute of British Foundrymen à Cheltenham. 555

Production de pièces saines en fonte grise.
Par I. C. H. Hughes, M.Sc., A.I.M.
Conclusion d'une revue des recherches récentes concernant le problème peu compris de réussite dans la production de pièces saines en fonte grise. 563

Revêtement de particules dans le procédé à la cire perdue.
Théorie et pratique de la fluidification de gaz—solide d'un procédé appliqué au revêtement de modèles pour le moulage à la cire perdue. 569

Werksbesuche in Westengland.
Ein Bericht über Firmen, welche am 17. Mai im Rahmen der Veranstaltungen der Cheltenham—Tagung des Institute of British Foundrymen besucht werden. 555

Herstellung von fehlerfreiem Grauguss.
Von I. C. H. Hughes, M.Sc., A.I.M.
Abschliessender Teil einer übersicht kürzlich durchgeführter Forschungsarbeiten über das wenig verstandene Problem, wie Fehlerfreiheit in Grauguss erzielt werden kann. 563

Überzüge auf Bestandteilen von Feingussformen.
Theorie und Praxis der Gas—feste Bestandteile—Verflüssigung, wie sie zum Überziehen von Modellen von Feingussformen angewandt wird. 569

Features, News, Commercial Information, and Statistics

Leader: Japanese Foundry Industry 553
Ironfounding Development Officers' Appointment 554
Dinner: Silica and Moulding Sands Association 554
Foundry Pig-iron Discussions 554
Luncheon: Foundry Trade Equipment and Supplies Association .. 554
ADA Annual General Meeting 568
Carborundum Jubilee 568
New Engineering Course 571
Notes from the Branches 572
Personal 574
" Export or pack your Bags " 575
Long Service at Hunt Bros. 575
Low-cost Automation 576
Open-hearth Steel Techniques 576
Anglo/Bulgarian Trade 576
News in Brief 577
Raw Material Markets 580
Current Prices of Iron, Steel, and Non-ferrous Metals 582
New Patents 584
Company News 586

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FOUNDRY
TRADE JOURNAL

Vol. 110 May 4, 1961 No. 2317

Japanese Foundry Industry

The Japanese foundry productivity team's visit to the United Kingdom has revealed information of considerable interest on their foundry industry, and this illustrates again how similar is the pattern of the structure of the industry in the leading countries and how parallel are the problems involved. The respective parts played by the captive and independent foundries, and the jobbing and specialized foundries, the special position of the steel industry in respect of the supply of raw material (*e.g.*, pig-iron and competition for scrap) and the domination of the small foundry by its clients in the engineering industry, appear to be features as common in Japan as in Western Europe.

Japan has 3,500 foundries of all types employing more than 10 persons, with a turnover valued in 1959 at about £150 millions, the 2,200 grey-iron foundries accounting for about two thirds of this, and producing 1·48 million tons of castings, apparently excluding pipes. There are over 400 foundries employing fewer than 10 people. In addition, in the same year, 81 malleable-iron foundries produced about 100,000 tons and 1,250 or so non-ferrous foundries some 81,500 tons. Among the iron foundries, one tenth of the number produced over one third of the output, and the larger the foundry the greater the tonnage output per man employed, doubtless due in part to the use of mechanical aids. In the engineering foundries, the output per man/year is about two thirds of the current British figure, but this of course does not mean that manufacturing costs are higher.

The Japanese industry is of course familiar with modern techniques,* and in fact over 120 iron foundries making castings of over 18 tons per sq. in. tensile have formed a High Grade Ironfounders Association. The country's special problems are considered to be the weakness of small foundries, started with little capital outlay as sub-contractors to the engineering industry and greatly affected by fluctuations in that industry. A depression strengthens competition for survival, and produces price-cutting and subsequent instability in the industry. The small foundry thinks in terms of production, and neglects production planning and sales promotion. On the other hand, a technically good foundry can fail in management. Other problems arise from the production of raw material such as pig-iron being in the hands of the steel industry, which also competes for available scrap. All this has a very familiar ring, and hence the steps taken by the leading foundry countries to meet these problems are likely to be on similar lines to those nearer home!

* Currently, one FOUNDRY TRADE JOURNAL out of every 15 copies printed is destined for Japan—Editor.

Ironfounding Development Officer's Appointment

As foreshadowed in earlier reports printed in the JOURNAL, the Council of Ironfoundry Associations, in co-operation with the National Federation of Engineering and General Ironfounders, has now appointed a market research and development officer. He is Mr. R. A. K. Loxley, 34, at present with Richard Thomas & Baldwins, Limited, of Ebbw Vale, who will take up his new duties on June 1.

Since 1951, when he came down from Oxford with an honours degree in engineering science, Mr. Loxley has had extensive experience on the design side in engineering works. A graduate apprentice of Vickers Armstrongs, Limited, he moved on in 1953 to the Glacier Metal Company, Limited, where he became successively senior development engineer and sales executive. He joined RTB after a spell abroad as assistant works engineer for Ets. Brampton S.A., Calais—the French subsidiary of Renold Chains, Limited.

Market development is regarded in the ironfounding industry as of increasing importance, it being felt that ironfounders have sometimes suffered from the lack of a co-ordinated effort in making known the importance in industry of iron castings, and the economics and advantages to be obtained from closer co-operation in the design field between founders and their customers, actual or potential. This new appointment has been made in order to provide a fountain-head from which to implement and sustain new development policies.

Dinners

SILICA & MOULDING SANDS ASSOCIATION

The annual dinner of the Silica & Moulding Sands Association was held at the Savoy Hotel, London, on Wednesday, April 26, and included a very large proportion of guests from the foundry industry and the glass and refractories industries in the total of 180 attending. The chairman for the function was the president of the Association, Mr. F. W. Robinson (Thos. W. Ward, Limited). After the Loyal Toast, Mr. G. R. Shotton (president, Institute of British Foundrymen) proposed "The Silica and Moulding Sands Industry," which was replied to by Mr. Robinson. Amongst his remarks, Mr. Robinson referred to the recent establishment of a course for entrants into the quarrying industry, setting up a City & Guilds qualification for quarry management personnel. He also foreshadowed the publication by the Association of a survey of the United Kingdom foundry sand resources. Mr. A. R. Abraham, M.A. (president-elect, Silica and Moulding Sands Association) proposed "The Guests," to which Dr. W. M. Hampton, O.B.E. (chairman, British Glass Industry Research Association, and past-chairman, Society of Glass Technology), responded. Entertainment was provided by Miss Soo Bee Lee, appearing by permission of the Glyndebourne Festival Opera, and accompanied by Mr. B. Sumner. The arrangements for the function were in the hands of Mr. G. K. Timperley, secretary of the Association.

Mr. G. V. TAYLOR, works manager at the Newport factory of Monsanto Chemicals, Limited, is retiring on June 1, and will be succeeded by Mr. A. C. W. PEMBERTON, general superintendent of technical services at Monsanto's Fawley factory.

Foundry Pig-iron Discussions

At an evening meeting attended by many London-area ironfounders and organized by the Stanton Ironworks Company, Limited, at the Trocadero Restaurant, London, W.1, on April 25, a film was used to pave the way for discussions on foundry pig-iron, its production and marketing arrangements. Mr. M. E. Fishburn of Stanton introduced the film, entitled "The Manufacture of Stanton Pig-iron" (originally prepared in 1954) and thereafter Mr. E. M. Summers, director and general manager, iron production at Stanton, gave a lengthy account of the whole scope of foundry iron production activities at the blast-furnaces of the group. He also showed about 20 slides of the modern developments of the plant, after describing the varied requirements of customers and the way they were met by pig-iron suppliers. Amongst other figures he quoted was that the present ore stock at Stanton blast-furnace plant consisted of no less than 24,000 tons and that the firm's new ore-preparation plant (described in the JOURNAL, December 10, 1959) had cost £4,000,000 out of the £8,000,000 total spent by the firm on post-war development of its pig-iron producing plant. During the period, capacity had doubled to a total of 650,000 tons per year. Discussing quality, Mr. Summers described how it was now possible—by adding low-phosphorus ore-fines to the sinter-plant burden—to produce foundry pig-irons from the firm's blast-furnaces with as low as 0.5 per cent. phosphorus, or with further special sinter material down to 0.25 per cent. phosphorus. This led the speaker to express the view that to provide phosphorus ranges between 0.25 per cent. and 1.3 per cent., with all the other variations of carbon, silicon and manganese, to a total of 120 specifications for pig-iron, was really too wide a range for economic working. He asked ironfounders if, with co-operation, it was possible to reduce this number.

Discussion

The discussion which followed Mr. Summers' address centred largely on this possible reduction of specifications demanded by founders, but some very pertinent questions were also asked on price, delivery and batch consistency. Other officials of Stanton who were present, including the chief metallurgist, assisted in the replies to questions which carried the meeting into the late evening. During the proceedings, refreshments were served to the guests.

This idea of having round-table discussions at which founders can meet their major suppliers is one which can do nothing but good and the frankness displayed at this meeting is worthy of emulation in other spheres. Foundrymen, least of all, favour a multiplicity of specifications, but it is clear that propaganda will have to be directed also to engineers if reduction in types of iron is to make much headway.

Luncheon

FOUNDRY TRADES EQUIPMENT & SUPPLIES ASSOCIATION

Approximately 60 representatives of member-firms foregathered at the Grand Hotel, Birmingham, on Friday last for the half-yearly luncheon of the Foundry Trades' Equipment and Supplies Association. The chair was taken by the president, Mr. W. E. Aske, supported at the top table by a number of past-presidents and members of Council. In the afternoon, there was a short informal discussion on subjects of general interest to members.

West of England Works Visits

Details of Plants and Processes to be inspected by IBF Parties during the Cheltenham Conference.

The West of England generally, where this year's annual IBF Conference is sited, is not an area containing a great many foundries. Thus, the choice of works which could be visited has been somewhat narrower than of late—as last year in the Midlands and before that on Tees-side, for example. Nevertheless, the area does contain a number of large foundries, some of them of a specialized type, catering for all cast metals (except possibly ordinary carbon steels). In addition, parties will travel and inspect smaller establishments, all of which are anxious to show no less a standard of technical proficiency and good-housekeeping than their larger neighbours. Out of a large number of invitations, the Institute has accepted those from a wide cross-section of the local industry and in aggregate, the IBF visitors are likely to be pleasurably surprised by both the diversity of manufactures in the area and high standards of foundry craftsmanship and versatility displayed for them.

This year, the Institute of British Foundrymen, when organizing its annual conference in Cheltenham (under the auspices of the Bristol & West of England branch), have set aside the Wednesday of Conference week, May 17, for a series of works visits in the area. In all, eleven works are to be toured by parties; most of them are foundries, but there are also some other plants to be seen which are of ancillary interest to founders. Brief particulars of the set-up of nearly all these works are contained in the following pages. The surveys will provide the conference delegates with pre-conceived notions of what to look out for at the various plants and serve as *aides memoires* when they come to describing what they have seen, for the benefit of colleagues back at their home foundries. For those not privileged to attend the visits, the accounts add to the JOURNAL's already extensive documentation of the foundries of this country. (In aggregate, over 500 separate establishments all over the world have been described in this JOURNAL over the past ten years.)

Aerial view of Newman, Hender & Company, Limited's, works, typical of the rural location of some of the foundries to be visited during the conference. (A description of this works will appear in a later issue of the JOURNAL.)

Bristol Siddeley Engines, Limited

Bristol Siddeley's light-alloy foundry at Patchway, Bristol, dates back to 1922 when Bristol aero-engines were being made by what was then known as the aero-engine department of the Bristol Aeroplane Company. The department, then only two years' old, was experiencing difficulty in obtaining sound cylinder-head castings in aluminium and the decision was taken to set up a foundry for this purpose. This was completed in six weeks and a good supply of satisfactory castings was available in three months. During the expansion of the

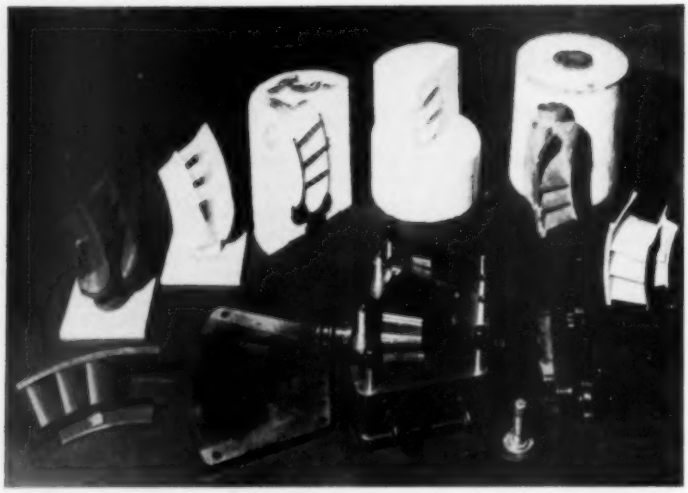


FIG. 1.—*Precision casting by the "lost wax" process at Bristol Siddeley Engines, Limited. Shown are (centre) the die; (clockwise from the left) wax pattern, pattern invested, sectioned mould, casting and finished product.*

factory which took place in the late '30's as part of the process of rearmament, a new and larger aluminium foundry was built and put into commission in 1939. From this time onwards, a small but growing amount of experimental work on the casting of magnesium alloys was undertaken and, in 1952, the casting of gas-turbine components in magnesium/zirconium alloys began on a production basis. Research into the lost-wax process began at Bristol in January, 1942, and the first casting was produced in the following August. Work was at first confined to the laboratory, but in 1945, a production section was formed in the existing foundry. When facilities there became inadequate, a new building was put in hand and the department moved into it in 1953 (see Figs. 1 and 2).

Light-alloy Foundry

The light-alloy foundry at Patchway (Fig. 3) produces a variety of castings in aluminium and magnesium alloys, ranging in weight from a few ounces to five or six cwt. Melting is carried out in a separate section containing segregated aluminium and magnesium melting bays. Moulds are conveyed by trackways from the moulding shop to the appropriate casting chamber and a thorough system of fume extraction ensures that the atmosphere is as free from fumes as possible.

The principal aluminium alloys used are RR 50, RR 350 and DTD 424. They are melted in gas-fired furnaces either of the axially-tilting type with plumbago crucible or of the pit-type with steel crucible. Dry nitrogen is bubbled through the melt to remove any hydrogen present. The magnesium-base alloys used are ZRE 1 and ZT 1. The Magnesium Elektron procedures for melting and casting are followed under licence from Magnesium Elektron, Limited, melting taking place in pit furnaces with steel crucibles. The quality and condition of the core and moulding sands are carefully controlled by routine tests in the sand laboratory for moisture content, permeability, grain size and clay content. Test-pieces are checked in compression and shear for dry tensile-strength. Tests for surface hardness and collapsibility are also carried out when development mixtures are being investigated.

For magnesium castings, Redhill "F" synthetic sand is used for moulding, bonded with Fulbond and faced with 100 per cent. virgin sand. After use, the facing sand is mixed with the backing sand and serves to make good the inevitable wastage. Cores for the magnesium foundry may be made from a mix similar to the facing sand and clay bonded, but the majority now consist of a synthetic sand with a sodium-silicate

FIG. 2.—*Wax patterns of stator blades (left) and flame-tube swirl-nozzles (right) receiving their primary investment coating in Bristol Siddeley Engines' precision foundry.*

FIG. 3.—*General layout of Bristol Siddeley Engines' light-alloy foundry.*

bond hardened by carbon dioxide. In the aluminium foundry, moulds are made from Mansfield Red semi-synthetic sand and cores principally from Redhill "F" with a sodium-silicate bond hardened with carbon dioxide.

To ensure consistency of the composition and mechanical properties of the alloys used, test-bars are cast from each melt and heat-treated with the castings they represent. They are subjected to tensile and elongation tests and to chemical and spectrographic analysis. After fettling, castings are visually inspected. Magnesium-zirconium castings are fluoride anodized before inspection and later chromated in another shop. Surface defects are checked by an oil-and-chalk test and some castings—such as automobile cylinder-heads—are air-pressure tested under water to detect any material defects. Radiographic inspection is also used to reveal internal defects. A 140 kV. Victor set, housed in a department within the foundry, allows adequate penetration for the majority of light-alloy castings. Radiographic inspection is also most valuable in proving new techniques and this is a matter of great concern to the light-alloy foundry.

Precision Foundry

The lost-wax process, practised for more than 1,000 years by goldsmiths and silversmiths, has recently been developed for industrial use to obtain accurate castings for parts which would be difficult to machine on account of their intricate shape or the refractoriness of the material or both. The process was introduced into the country from the US in 1941 and adopted at the Patchway works the following year. Since then, the company has made many contributions to its development. Typical products of the company's precision foundry are turbine stators and blades, pipe elbows and combustion-chamber swirlers. Limits of the order of 0.005 in. are maintained and the surface finish is excellent.

The first step in the process is the manufacture of a steel die which is in effect a mould of the part to be cast. Liquid wax is injected into the die at a pressure of about 40 lb. per sq. in. and a temperature of about 40 deg. C. to produce the pattern. Various types of wax are used, a typical one has a composition of 60 per cent. paraffin wax, 25 per cent. flexoresin and 15 per cent. carnauba wax. In the section of the foundry where wax patterns are handled, the temperature is automatically stabilized at a constant level throughout the year to ensure that they shall be neither too brittle in winter nor too soft in summer. The cooled patterns are welded with an electrically-heated knife to a wax runner and test-piece and if they be small are attached to the same runner. The composite pattern is then dipped into a bath containing a fine alumina compound in water and covered with a coarse-grade alumina to bond subsequent coatings. The foundry at Patchway uses more than

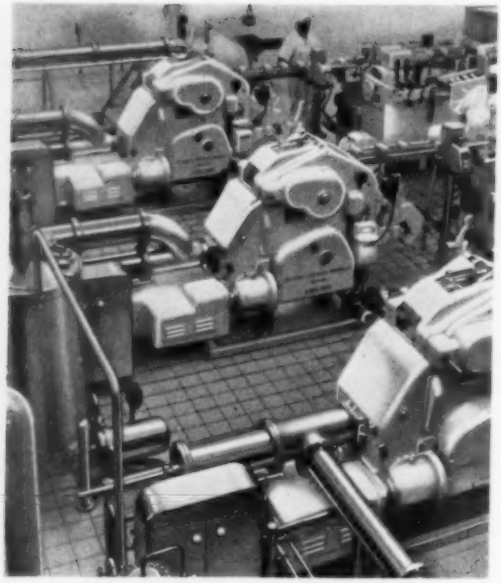


FIG. 4.—*Margarine-packing machines manufactured by Brecknell, Dolman & Rogers, Limited.*

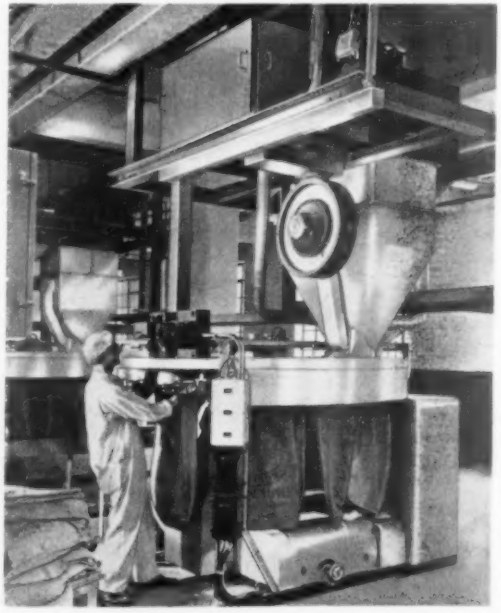
three tons of coating material per day. The wax is melted out of the completed shell which is then fired at 1,050 deg. C. for about two hours. Meanwhile, a weighed quantity of metal is melted in an electric furnace, these furnaces being mounted on trunnions and having a flat top surface to which the shell can be clamped. Pouring takes place by inverting the furnace and is assisted by air pressure at between 5 and 10 lb. per sq. in. After cooling, the moulds are broken open and the components are heat-treated to relieve stresses. The test-pieces go for laboratory analysis and the components are washed in an acid solution to remove all traces of refractory material and sand blasted, after which they undergo various inspection procedures.

Gas-turbine production involves the manufacture of many complex components from increasingly difficult materials and the handling problems associated with forging, machining, fabricating and casting will be further complicated by oxidation. A new foundry process employing vacuum melting and casting is already used by Bristol Siddeley and will further stimulate the development of investment-casting technique. The precision foundry at Patchway has been laid out to give a continuous production. It is highly mechanized with wide use of overhead and roller conveyors. When the company began its research little was known in Britain of the problems involved and no specialized equipment was available. All the plant used at Bristol Siddeley has either been designed by the company or built to its specifications and some of the processes it has developed are covered by patents.

Brecknell, Dolman & Rogers, Limited

For those who may prefer a change from the usual inspection of a foundry, the conference committee have arranged a visit to Brecknell, Dolman & Rogers, Limited, Pennywell Road, Bristol. This firm are manufacturers of wrapping and packing machinery and coin-operated vending machines. The works occupy an area of about 103,083 sq. ft. and some 1,200 workpeople are employed. The history of the company can be traced back to the year 1860 when it consisted of a small non-ferrous foundry founded by Henry Brecknell. Machines produced to-day (Figs. 4, 5 and 6) include such items as packaging machines for flour, sugar and similar products, moulding and wrapping machines for butter and margarine, egg-grading and -packaging machines, ticket-issuing and change-giving machines as used on the London Underground, laundry-marking machines, printing machines and a full range of coin-operated vending machines, including luggage lockers and stamp-booklet machines. To service their equipment, the company has an extensive maintenance organization covering the whole of Great Britain, Northern Ireland and the Channel Islands. They also do a large amount of export business where the servicing is carried out

FIG. 5.—*Brecknell, Dolman & Rogers' bulk-packing machines for filling and sealing paper or hessian sacks with flour or similar powdered and granular products.*



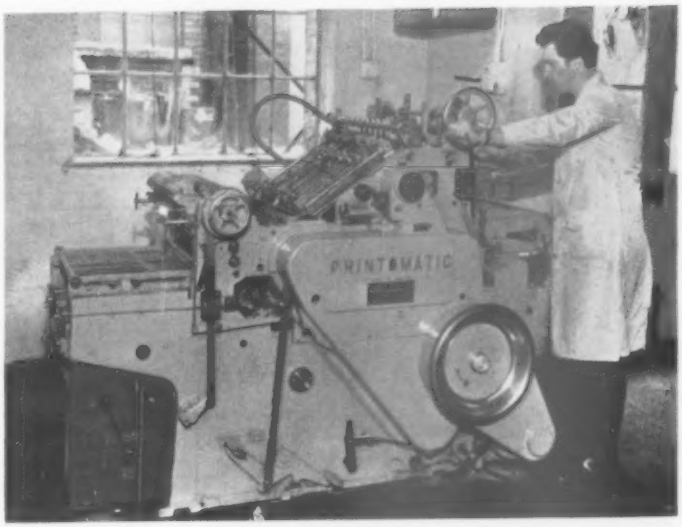


FIG. 6.—*BDR "Printomatic" high-speed stop cylinder letterpress printing machine, a large number of which have been exported to almost all the countries in the world.*

by their agency companies, with periodic visits by skilled engineers from the home works. Export business varies from year to year, but on some machines there is a big demand overseas—sometimes as high as 75 per cent. of the total. Plans are also being constantly made for further development of a steadily-increasing range of products.

Although it will not be inspected on this occasion, the firm have their own well-equipped non-ferrous foundry, handling gunmetals, phosphor-bronzes, "dairy" metal and aluminium alloys, etc. This is situated some little distance from the main works and deals with a large amount of outside business as well as the firm's own requirements.

At Brecknell, Dolman & Rogers, the relationship between management and employees is a very good one as it is the company's policy that the whole of its personnel shall participate in its prosperity. A generous share of the profits—proportionate to salary or wages—is paid out each year to all the staff in the form of an annual bonus. In addition, there are superannuation and retirement-benefit schemes for the staff and a sickness-benefit scheme. The social side is well catered for, the company's canteen and staff room being used for evening recreations, such as billiards, darts, etc. The company has its own football team and fishing club, and social evenings and dances are a regular feature of the social club, of which all employees are members. The company feel that it is this carefully-planned policy which has helped it to flourish for more than a century.

British Railways, Swindon Foundries*

In common with other main workshops of British Railways, the tonnage of castings produced at the Swindon Works, Western Region, remains more or less constant, as repairs to rolling-stock are programmed well in advance to ensure a balanced flow of work. In addition to the supply of castings for their own use, work is undertaken for other depots of the Western Region, the output consisting mainly of locomotive axlebox crown-bearings and liners, bogie axleboxes, carriage and wagon crown-bearings, cones, injectors, etc., from the non-ferrous foundry, and locomotive cylinders, cylinder-liners, smoke-box saddles, chimneys, etc., from the iron foundry.

Non-ferrous Sections

The mechanized continuous-casting plant laid down in the non-ferrous foundry (Figs. A and B) at the Swindon Works was first mooted in 1955 and the work of mechanization was put in hand in June, the mechanical-handling equipment being installed by Paterson Hughes Engineering Company, Limited. The non-ferrous foundry building is some 80 years old and little alteration had been carried out in the ensuing years except for the modernization of the furnaces. Mechanization of the foundry was carried out to improve working conditions, not—as is usually the case—because of a need to increase output. To-day, heavy manual lifting has been reduced to a minimum, the work is less onerous, and a cleaner atmosphere has been provided by the installation of fume- and dust-extraction equipment over all melting, pouring and knock-out areas.

Layout

The scrap-metal ingotting section supplying the non-ferrous foundry at Swindon is a self-contained unit equipped with a two-ton capacity Sklenar oil-fired furnace. An overhead runway with geared-type ladles and hoists facilitates pouring and ingot moulds are carried on fixed tracks with trunnions for tilting. The melting section of the foundry itself consists of two LO2 type Morgan oil-fired lift-out crucible furnaces and four Sklenar oil-fired tilting furnaces, two of 10-cwt. and two of 4-cwt. capacity. The slat conveyor at the pouring area is power driven and approximately 32 ft. long, pouring being carried out by means of 5-cwt. capacity geared-type ladles carried on a 10-cwt. ladle hoist. The ladle conveyor is of the twin-bar type and extends some 75 ft., covering the area given over to floor moulding, this area occupying 840 sq. ft. of

* Based on full accounts of these foundries which appeared in the June 15, 1956, issue of "The Railway Gazette," and the April/June issue of "British Machine Tool Engineering."

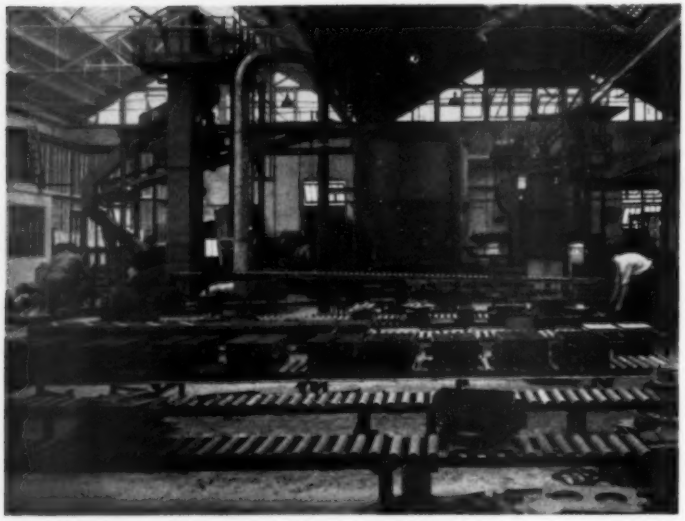


FIG. 7.—*General view of the non-ferrous foundry at the Swindon Works of British Railways. Note the gravity roller conveyors at the rear for returning boxes from the knockout to the moulding machines. Also in the background is shown part of the sand-preparation plant.*

floor space. Hand moulding is also practised and for this, eight moulding benches are installed, equipped with individual sand hoppers.

The machine-moulding plant at Swindon consists of four Coleman-Wallwork type WT 563 moulding machines, one WT 563c by the same makers, one HEB 1 type supplied by Foundry Equipment, Limited, and two older machines. The sand supply over the machines is controlled by a hand lever from overhead hoppers. After casting, the boxes are conveyed by gravity conveyor to the fully-ventilated Vibreco knockout where sand is vibrated on to a 24-in. wide knockout belt, thence to a 10-in. bucket-type elevator, through a Vibreco screen to a 20-in. wide conveyor belt, and is finally discharged into a 15-ton capacity sand-storage hopper. A secondary conveyor is installed to serve as an additional cooling area between the casting stage and the knockout, this being necessary because of the varied weights and grades of castings produced.

The sand-conditioning plant consists of a 15-ton capacity storage hopper with a rotating base by means of which the sand is ploughed off into a skip hoist which, in turn, transfers it to a Speedmuller, model 40 (by Herbert Morris, Limited), in which the sand is reconditioned. Milled sand is distributed to the hoppers over the machines and to the hand-moulding benches by means of a 30-cwt. electrically-controlled hoist with drop-bottom skips.

Other Non-ferrous Departments

The fettling department of the Swindon Works is well equipped and consists of a Hetherington fettling drum, a Spencer & Halstead sandblast cabinet, a Coleman Foundry Equipment, Limited, cutting-off machine, two Rowland grinders and a guillotine supplied by Robert Bros. The sandblast cabinet is used for small castings and a larger machine handles the heavier castings and is housed in an adjoining building. Coremaking is carried out in an adjacent shop and the foundry has its own patternshop, self-contained oil-supply system, and there are also amenities for the employees consisting of a canteen, clothes-drying and the usual washing facilities.

Iron Foundry

The iron foundry at the Swindon Works is divided into two sections, one devoted to the production of heavy castings such as locomotive cylinders, cylinder-liners, chimneys, smoke-box

FIG. 8.—*Pouring section of British Railways non-ferrous foundry showing the arrangement of local lighting and double fume-extraction canopy.*

saddles, etc., and the other to lighter, repetition castings such as axlebox tops and bottoms, carriage steam-radiators, engine firebars, engine and carriage brake-blocks and other parts needed in large quantities. Incidentally, engine and carriage brake-blocks produced account for over half of the total tonnage of castings. Mechanical-handling equipment in both sections consists of (on the heavy side) two overhead-travelling electric cranes each of 20-tons capacity and (on the lighter side), a similar crane of 10-tons capacity. In addition, swivelling jib cranes are spaced at intervals along the cupola side of the heavy bay; some of these cranes are steam operated, some electric, and will lift up to five tons.

Operational Procedures

The practice is to operate one of two cupolas on alternate days and under normal working conditions, the output is at about the rate of 11 tons per hour. Whilst an anvil block of 65 tons weight has at one time been cast in this foundry, the larger castings produced are not usually more than 12 tons in weight. Molten metal for the light side of the section of the iron foundry is brought from the cupolas to the moulds by specially-designed ladles with spring shock-absorbers, carried on a pair of wheels, and having a long handle and locking device. Before the metal can be poured, the locking device has to be disengaged.

Many types of cores are used in the iron foundry, oil sand being employed for the smaller cores. Some of these are prepared by hand and some in machines manufactured at Swindon. A more elaborate machine of the turnover type is employed for making engine brake-block cores. Thermostatically-controlled gas-ovens are used for oil-sand drying, there being two ovens, kept at 180 deg. C.

Chair Foundry

The chair foundry at the Swindon Works has an annual production of 8,000 tons of castings. Two cupolas with an output of approximately 10 tons per hr., each of which is used on alternate days, supply the metal required here. The foundry is L-shaped, the cupolas being sited at the junction of the arms. Moulds are prepared with the aid of two special Swindon-made transportable moulding machines which are wheeled as required between rows of specially-designed steel moulding boxes.

R. A. Lister & Company, Limited

The foundry of R. A. Lister & Company, Limited, Dursley, Glos., is one of the most modern in Europe and one of the first things which is expected to strike the visiting foundrymen is that there is a remarkable absence of the arduous work normally associated with foundries.

The company has its own railway sidings and trucks bring the raw materials right up to the charging bay, which is serviced by a magnetic crane. Stocks of pig-iron, coke, etc., are stored here and the charges for the two hot-blast cupolas

FIG. 9.—*Employees at R. A. Lister's foundry are exhorted to make use of protective clothing available to them and this photograph of pouring shows that the men do in fact wear goggles, footwear, leggings, etc., in the interests of personal safety. The man travels on the pallet conveyor while pouring.*

are carefully weighed under the direction of the foundry metallurgist before being mechanically chargd into the cupolas. Samples of molten iron, sand used for moulding and coremaking, and all other materials are subject to continuous control in the foundry laboratory. The cupolas (Fig. 10) melt 8 to 10 tons of iron per hr., two of the units being used on one day and the remaining two being prepared for the following day's melt. Approximately 400-500 tons of metal are poured per week into moulds on moving conveyors (Fig. 9) which carry them through a fume chamber where all gases and steam are extracted, thus maintaining a clean atmosphere in the shop. Emerging from this chamber, the moulds are shaken out on mechanical vibratory screens which are provided with dust and fume extractors. The hot castings are loaded on to a conveyor which carries them outside the building to allow them to cool before delivery to the fettling shop. After being treated by rumbler or automatic shotblast, they are placed on a dual-duty conveyor for individual fettling and inspection, finally passing to the stores where they are ready for delivery

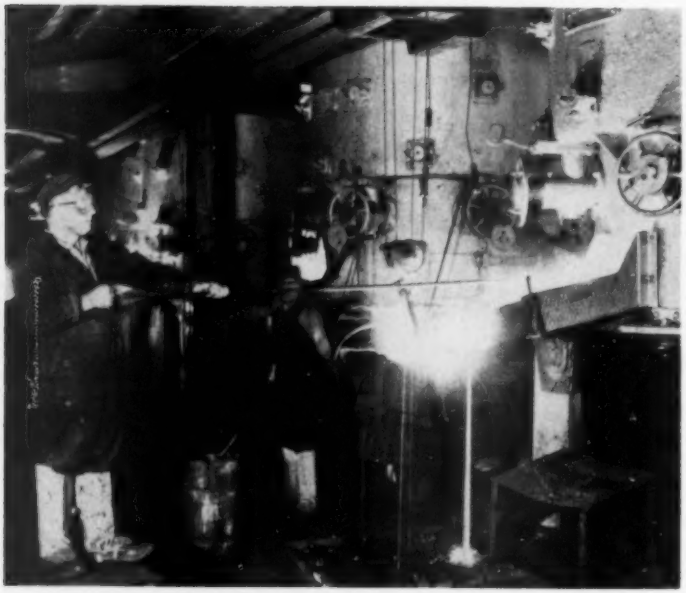


FIG. 10.—*Tapping out at the cupolas. Note the use of heavy-duty shrouded monorails for carrying the pouring ladles (R. A. Lister & Company, Limited.)*

later to the company's machine-shop. Another section of the foundry is devoted to the making of crankcases and the heavier flywheels and this is serviced by an overhead crane. Elaborate use is also made of electrical and compressed-air-driven equipment and hoists to maintain a high degree of mechanization throughout the plant.

Coreshops

The company has two coreshops, one employing men making the heavier cores either by hand or with coreblowing machines, the other employing women using coreblowing machines and producing approximately 10,000 cores per day. After being baked, the cores are specially coated to withstand the high temperatures of the molten metal and are then redried, before being jointed, finished, gauged and assembled before delivery to the moulding tracks where they are inserted in the moulds. Adjacent to the two moving conveyor tracks which travel at a speed of 12 ft. per min. (and as near to the cupolas as possible), are situated pneumatic moulding machines of various types—automatic cycle, jolt-squeeze, pin-lift and rollover—in addition to shellmoulding equipment of the latest design.

The sand-reconditioning plant is fully mechanized. To the used sand (which is recovered by underground conveyor) bonding clay and water are added as it passes through the system, to bring it back to the correct strengh necessary for the production of sound castings. The whole process is controlled by the foundry laboratory staff.

Considering the weekly output of the foundry and that the average rough casting weighs 5 lb., it will readily be appreciated the delicacy and quality of the work carried out by Lister's foundry and the efficient administration and organization which enable such a large quantity of castings to be produced each day.

(Descriptions of other works to be visited by IBF conference delegates to follow shortly.)

International Foundry Congress Tours

The two post-Congress tours of the International Foundry Congress in Vienna, June 19 to 24, will, as mentioned in last week's JOURNAL, be identical in programme but in opposite directions. They will take the visitors to the industrial regions of Styria (after crossing the Semmering Pass south of Vienna) and to the Carinthian Lakes. Then, turning again north, the coaches will travel across the main Austrian mountain chains, using the famous "Alpine High Road," in full view of Austria's highest mountains and their glaciers (Grossglockner, 12,700 ft.).

After staying one night in Salzburg, the coaches turn eastwards, cross the lake district of the "Salzkammergut" (where is located the White Horse Inn of opera fame) and arrive at Linz in Upper Austria the same evening. The next day is reserved for a visit to the very large and modern United Austrian Steelworks at Linz (on the Danube), where the LD process originated, followed by a visit to the St. Florian Monastery. Travelling along the Danube valley and through the vine-growing districts of the "Wachau" with the Durnstein Castle (where Richard the Lionheart was held prisoner), the coaches return to Vienna on the evening of the seventh day of the tour.

Works Visits

During the post-Congress tours the following works will be visited:—(1) Alpine Montangesellschaft, Donawitz (Styria), iron and steel foundry; (2) Austrian Foundry Institute, Leoben (Styria); (3) Böhler & Company, A.G., Kapfenberg (Styria), alloy-steel works, steel foundry; (4) Engineering works Andritz A.G., Graz (Styria), iron foundry; (5) Steyr-Daimler-Puch Motor Works, Graz (Styria), non-ferrous foundry; (6) Bauer & Company, Wels (Upper Austria), iron foundry and malleable cast iron; (7) United Austrian Steelworks, Linz (Upper Austria), iron and steel foundry, and (8) Bell Foundry St. Florian, Linz (Upper Austria), non-ferrous foundry.

Production of Sound Grey-iron Castings . . . . . Survey of Recent Research

*By I. C. H. Hughes M.Sc., A.I.M.**

Shrinkage problems in the production of grey-iron castings do not always yield to the application of theoretical feeding practice. They often arise unexpectedly and a satisfactory metallurgical explanation of apparently simple phenomena often eludes investigators. For the past 15 years a great deal of research has been directed by the British Cast Iron Research Association to the study of the mechanism by which unsoundness occurs in grey iron. This article is an attempt to review the progress that has been made so far and to suggest what new techniques of moulding and feeding might be effective in producing sound castings.

Continued from JOURNAL, *April 20, page 497.*

The first part of this article, concerned with an understanding of the metallurgical mechanism involved in the formation of shrinkage cavities in grey-iron castings, dealt with the following topics: A description of the nature of the solidification process; the significance of the number of eutectic cells in the incidence of unsoundness, and the role of phosphorus and silicon in promoting their growth; the effect of mould movement and its relationship to pouring temperature; the greater expansion of s.-g. iron as a cause of apparent shrinkage; inoculation as a stimulator of eutectic-cell formation, and the effect on the latter of metal condition and melting practice. The importance of the question of the actual number of eutectic cells leads to a consideration of the factors governing their emergence.

Cell Control

Hard and fast preditions cannot be made, but broadly the factors which decrease eutectic-cell number and so promote soundness are:

(*a*) Superheating. (*b*) Holding in a batch furnace, receiver or ladle. (*c*) Bubbling any gas through the iron using a non-graphitic tube. (*d*) Poling with a green pole. (*e*) Slow melting in a batch furnace. (*f*) Presence of titanium in the iron. (*g*) Hard blowing in the cupola.

TABLE 1.—*Factors Decreasing Eutectic-cell Number.*

Treatment carried out.	Mean depth of sink, in. by 10^{-3}.		Mean no. of eutectic cells per sq. in.	
	Before treatment.	After treatment.	Before treatment.	After treatment.
Poling with a green pole	0.65	−0.02	6,270	3,750
Bubbling carbon dioxide for 2 min. ..	1.18	0.05	7,930	3,860
Addition to furnace of 0.25 per cent. titanium	1.13	−0.02	8,080	4,550
Holding in furnace for 20 min.	1.15	0.23	9,580	7,430
Addition to furnace of 0.25 per cent titanium followed by bubbling CO_2 for 2 min.	0.23	−0.42	7,430	6,190
Bubbling oxygen for 2 min.	1.85	−0.09	7,590	1,950

Some of these effects may be used to exercise deliberate control over the metal as illustrated in Table 1. The deliberate addition of titanium contents up to about 0.3 per cent. and bubbling compressed air through ladles of metal are two processes which have been used very successfully by the BCIRA to cure shrinkage troubles in particular castings.

Factors which increase eutectic-cell number and so promote unsoundness are:

(*a*) Rapid melting in a batch furnace. (*b*) Low superheat. (*c*) Melting in contact with coke or other carbonaceous material. (*d*) Inoculation with graphitisers. (*e*) High sulphur content or low manganese content. In order to exercise control over the metal quality periodic checks of the eutectic cell number are necessary[9]. Samples of a similar size to micro-specimens may be cut from castings, or test bars specially cast, and these should be rubbed down to a fine-emery finish and etched for low-magnification examination. Two very important requirements must be observed. Cooling rate and pouring temperature modify the eutectic-cell number, so that castings for eutectic-cell counting must be poured at a pre-selected constant temperature and must always be examined at exactly the same point if valid comparisons between batches of metal are to be made. In most foundries pouring temperature is one of the greatest, most-important and least-controlled variables and standardization of pouring temperature for each type of casting made is probably the most-valuable single metallurgical improvement which could be made in the operation of very many plants.

Soundness of Nodular Iron

The basic problem of the soundness of nodular iron is not really different from that for grey iron, as the foregoing remarks indicate. Feeding this iron is normally found to be necessary in greensand moulds, but the feed metal require-

* The Author is on the staff of the British Cast Iron Research Association.

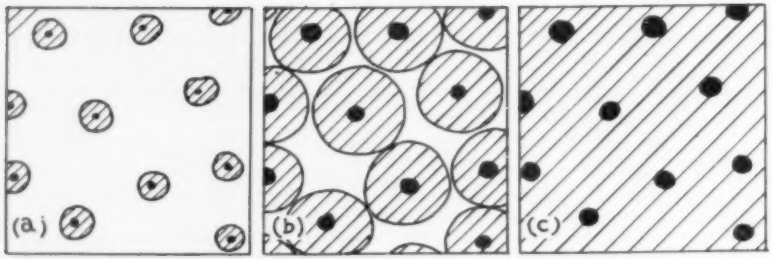


FIG. 18.—*Diagram illustrates stages in eutectic-cell growth from nodular-graphite liquid*: (a) *Start of cell formation;* (b) *cells multiply as temperature falls;* (c) *fluid austenite is used up, leaving graphite nodules in eutectic matrix.*

ments are essentially those to offset mould-cavity expansion during solidification. Use of drysand moulds greatly improves the yield and dimensional accuracy, while CO_2-process moulds are also very useful and may even make the use of feeders unnecessary for smaller castings. When using CO_2-process or coresand moulds it should be remembered that the benefit of rigid mould materials will be lost if the mould parts are not rigidly held together. The expansion forces during solidification are considerable and may easily lift the top of a badly weighted or clamped box and yield an unsound casting. The reason for the greater expansion force of nodular irons must lie in the solidification sequence of the nodular-graphite eutectic—which is the only feature in which the solidification of nodular-graphite irons differs from that of flake-graphite irons. Fig. 18 illustrates schematically the solidfication of the nodular graphite eutectic and shows that as in the flake-graphite eutectic, solidification begins at a number of points or nuclei, at each of which one nodular grows together with the austenite matrix which forms an envelope. These nodules grow until the austenite envelopes touch and the liquid is all used up.

This process differs in several respects from that in flake-graphite iron, but perhaps the most significant is the fact that the number of eutectic cells, represented by the number of nodules, is probably hundreds of times greater than the number of cells per square inch of a flake-graphite iron. As described earlier, in flake-graphite irons the greater the cell number the greater the expansion of the casting and the greater the tendency to unsoundness. Perhaps the much-higher cell number in nodular irons represents an extension of the same series to even greater expansive force and unsoundness tendency.

Composition Variations

Although the effects of varying composition are not generally as important as those of varying mould properties, pouring temperature and metal quality, they nevertheless are quite clearly definable and in some castings must be carefully controlled. When large changes in composition occur alone, or small changes occur at the same time as changes in the moulding technique, metal quality or pouring temperature, then unsoundness may appear in susceptible castings. The effects of composition changes are all clearly explainable in terms of the

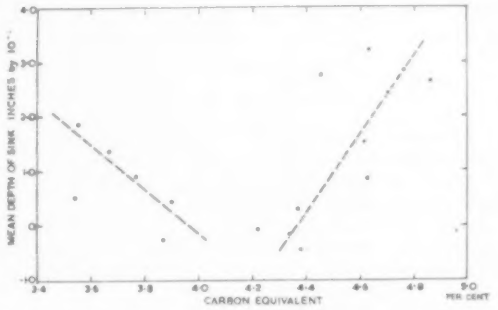
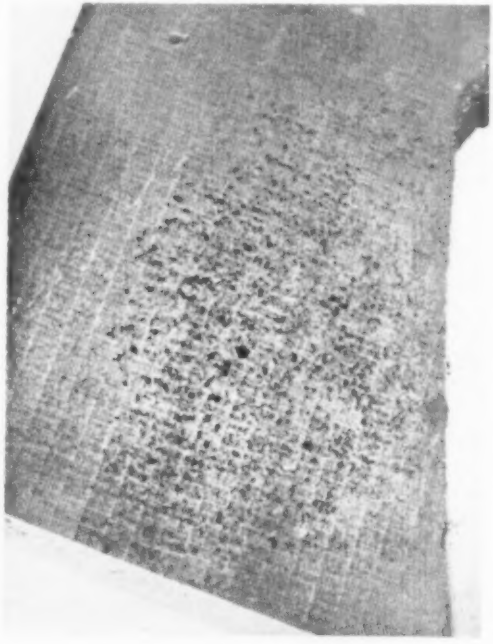


FIG. 19 (*above*).—*Sink-depth related to carbon equivalent in test castings.*

FIG. 20.—*Section of a large casting which shows serious open-grain. This could be greatly reduced by lowering the carbon-equivalent value.*



principles which have been described above, and will now be briefly discussed.

Carbon and Silicon

The principal effect of these elements lies in the amount of eutectic graphite which forms and governs the amount of the expansion stage of solidification. As a rule the expansion due to graphite formation is desirable to ensure that however much the casting volume decreases during solidification the increase in volume of the iron will be sufficient to fill it and so avoid porosity or cavity formation. We have seen that, roughly speaking, maximum eutectic graphite occurs at the eutectic composition, and the maximum soundness will normally be expected in irons of carbon equivalent about 4.3 per cent. Fig. 19 shows how minimum surface-shrinkage occurs in plate-with-boss test castings of a particular design at a carbon equivalent content about 4.2 per cent. This state of affairs is generally true for light-section castings

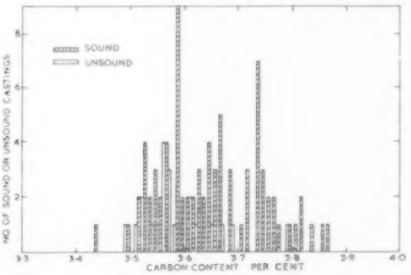


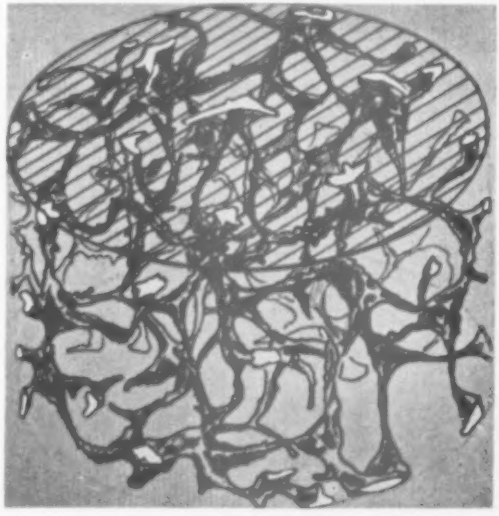
FIG. 21.—*Histogram illustrating soundness of ingot-mould castings of varying-carbon content.*

and castings made in good firm moulds. In heavier castings, however, and those made in softer moulds the reverse effect may occur because the expansion of the graphite formed during solidification may help to increase the size of the mould cavity, by the mechanical effect described earlier, to such an extent that shrinkage defects occur. This defect in a mild form appears in open grain as shown in Fig. 20 and is particularly likely to occur in large flat castings and cylinders. Here the remedy is to lower the carbon-equivalent content. Although carbon equivalent is a good rough guide to eutectic graphite and to soundness, it should be remembered, as stated earlier, that a given carbon-equivalent value carbon makes a greater volume contribution than silicon so that when maximum soundness in small castings is required a high carbon, low silicon iron is the best. Analogously, in reducing open grain or porosity in large cylinders or machine beds by lowering the carbon equivalent it is better to lower the carbon than the silicon.

In making cast-iron ingot moulds, where very-rigid sand moulds are used, maximum soundness is obtained by using a high-carbon content, as shown in Fig. 21.[1] Feeding is required to offset mould-

FIG. 22.—*Photomicrographic representation of phosphoric grey iron does not reveal network character of the phosphide eutectic; this emerges clearly in the figure below.*

FIG. 23.—*Sketch showing phosphide-eutectic network in a* 0.4 *per cent. phosphorus nodular iron.*



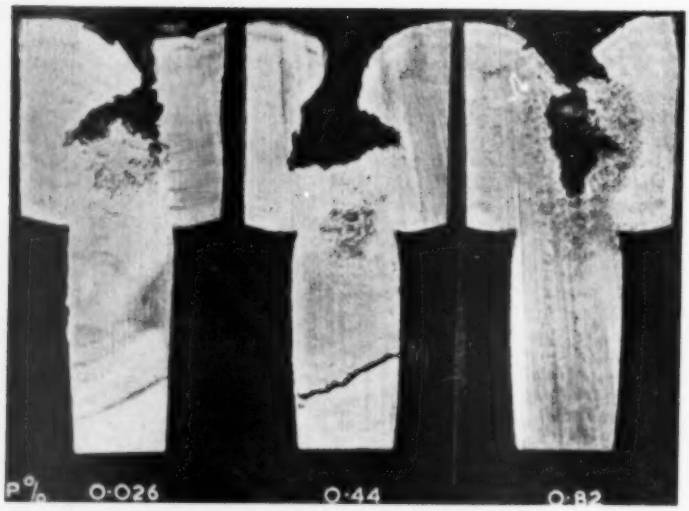
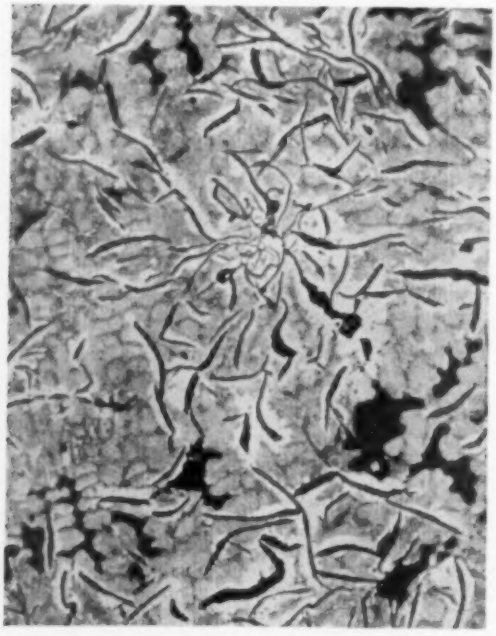


FIG. 24.—*Nodular-iron keel-block castings with increasing phosphorus contents as indicated. Shows increased keel expansion and feeding requirements with increasing phosphorus.*

wall movement under high hydrostatic pressure and also liquid shrinkage due to contraction of the liquid iron on cooling before solidification begins. In such castings mould-wall movement is probably not much affected by composition but high carbon will give a hyper-eutectic iron which will show less total liquid shrinkage before solidification begins.

FIG. 25.—*Porosity in phosphoric grey iron is here graphically demonstrated.*



Phosphorus[10]

Phosphorus makes a contribution to carbon equivalent in the way described earlier, but the major effect of this element is to promote the formation of internal porosity at all levels above about 0.2 per cent. Phosphorus forms a low-melting-point eutectic liquid which prolongs the time before the casting is fully solid and it solidifies to give a characteristic microstructure, shown in Fig. 22. Although the phosphorus-rich eutectic regions appear generally as irregular-shaped particles they in fact form a continuous network of the type sketched in Fig. 23. This figure is a drawing made of the appearance of a deeply-etched phosphoric nodular-iron specimen through a stereoscopic microscope. Here the matrix was etched away and the graphite nodules shaken out, leaving the phosphide network. A similar structure can be seen in deeply-etched flake-graphite irons but it is less easy to view because the graphite flakes cannot be removed. This low-melting-point phosphorus-rich liquid can flow freely within the casting and can even be squeezed out at points on the surface, yielding phosphide sweat. It is associated with greater casting expansion and resulting general shrinkage characteristics (especially in nodular iron, as shown in Fig. 24) and it tends to flow away from hot spots, where it leaves fine dispersed porosity as shown in Fig. 25. This type of porosity is greatly aggravated by hot spots and it cannot be fed by conventional means because the melting point of the phosphide liquid is too low for it to be replaced by liquid cast iron, which will not flow through fine channels which form below its normal melting point.

Sulphur and Manganese[5]

Increasing the sulphur content increases the eutectic-cell number in castings and so leads to increased casting expansion and unsoundness in smaller and thin-sectioned castings. This is illustrated in Fig. 26. Manganese neutralizes sulphur and so has the opposite influence, as shown in Fig. 27. This neutralization is most effective at low-sulphur contents, so that for maximum soundness a low sulphur content is recommended, with a manganese content sufficient to satisfy the formula which is commonly found satisfactory,

namely: Manganese content = 1.7 by sulphur content + 0.3 per cent.

Trace Elements

Most of the shrinkage defects which occur in grey iron are governed by the factors mentioned above. Trace elements generally have no important effect, but titanium, when present in amounts above 0.1 per cent., may have a beneficial influence because it reduces eutectic-cell number and so promotes soundness. In the early literature gases were often stated to be a general cause of shrinkage defects. This viewpoint is not supported by the results of research on soundness, and although the gases themselves have not been found to have a significant influence on shrinkage defects, their use for bubbling has been demonstrated to be beneficial as indicated earlier. It is occasionally found that most abnormally-high hydrogen or nitrogen contents may produce defects but they are usually very characteristic in form and quite unlike the defects discussed in this paper.

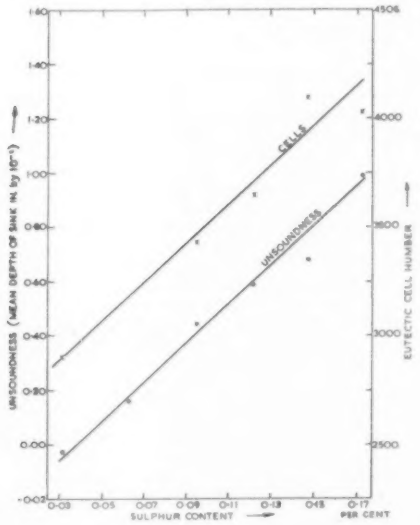


FIG. 26.—*Direct relationship between sulphur content, eutectic-cell number and unsoundness is readily appreciated from the above straight-line graphs.*

Foundry Practice

The features of grey-iron soundness described are of importance in the foundry, as is illustrated by various papers describing the cause and cure of shrinkage problems arising in commercial castings.[1, 6, 7, 11, 13] For convenience and clarity this paper has been illustrated with some laboratory-scale examples, but there has always been a close liaison between the investigators whose work is reviewed and many BCIRA member foundries where laboratory results have been amply verified in the course of production.

Summary

A considerable study of the causes and cures of so-called shrinkage defects in grey cast iron has made it possible to summarize present knowledge as follows: (1) During solidification, overall expansion of the casting is accompanied by the formation of unsoundness and this unsoundness is particularly aggravated by hot spots. (2) Conventional feeding compensates for true liquid shrinkage prior to solidification and for mould-wall movement before and during solidification, but it may not offset cavity formation and porosity, especially in phosphoric irons. (3) Nodular and phosphoric irons present greater problems mainly because the casting expansion forces are greater. (4) To promote soundness the three factors which have the main effects are: (*a*) Use of moulds of increased rigidity. (*b*) Use of metal of appropriate quality giving castings of low eutectic-cell number. (*c*) Use of lowest reasonable pouring temperature.

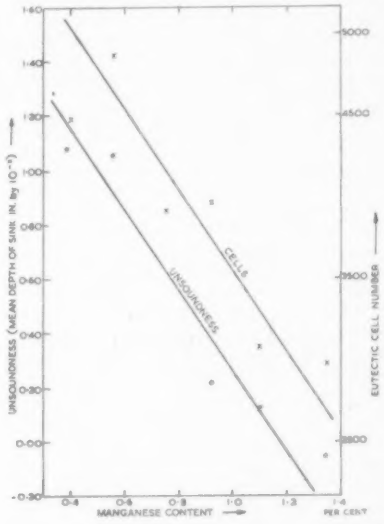


FIG. 27.—*The role of manganese in suppressing eutectic-cell formation and promoting soundness emerges strongly in this graph.*

Acknowledgments

Many past and present members of the Association's staff have contributed to the views expressed, notably A. A. Timmins, J. H. Gittus, K. E. L. Nicholas, A. G. Fuller, A. D. Morgan and J. M. Greenhill. This paper is published by permission of the director and Council of the British Cast Iron Research Association.

(*References appear on following page, at foot of col. one*)

ADA Annual General Meeting

The Aluminium Development Association held its annual general meeting at 33, Grosvenor Street, London, W.1, on Friday, April 21. Mr. W. Brining, the retiring president, who presented the annual report, referred in his introductory comments to the satisfactory continuance of the Association's work in the directions of research, development and information during the period reviewed.

Election of Officers

At the meeting, Mr. G. W. Lacey, C.B.E., B.SC., F.R.I.C., assistant managing director (overseas) of British Aluminium Company, Limited, was elected president for 1961-62. Mr. Lacey was with Lever Bros. Port Sunlight, Limited, from 1914 to 1928, except for war service 1915-1919, and for the next nine years he was with the Birmingham Aluminium Casting (1903) Company, Limited. In 1937, he began his career with the British Aluminium Company, Limited, interrupted, again for war service, in the second world war, when he seconded to the light metals control of the Ministry of Aircraft Production, as Controller of Light Metals. In 1945, he returned to British Aluminium as a director. The honour of C.B.E. was conferred on him in 1946. Mr. Lacey served as a member of the Council of Industrial Design from 1947 to 1959.

The new president was a member of the executive committee of the Association from 1945-1959 and served as its chairman for two years. Since 1959, he has been a member of the Council of the ADA.

On relinquishing the presidency of the Association, Mr. W. Brining, representative of the Almin group of companies on the Association's Council, was appointed vice-president. In consequence of the resignation of Mr. G. Meredith from the executive committee, Mr. R. T. Raven (Birmetals, Limited) was appointed chairman of the executive committee. Mr. P. S. W. Swabey (general manager of development, British Aluminium Company, Limited) was appointed to the executive committee following the resignation of Mr. G. A. Anderson of the same company.

Production of Sound Grey-iron Castings

(Continued from preceding page)

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Carborundum Jubilee

Carborundum Company, Limited, Trafford Park, Manchester, is celebrating its golden jubilee. The company stems from the pioneering research work of Dr. Edward Acheson who, in the late nineteenth century, discovered that the reaction of a mixture of clay and powdered coke at a very-high temperature provided crystals that would scratch glass as easily as a diamond. These were found on analysis to be silicon carbide. Dr. Acheson named the crystals "Carborundum" and formed the company with the name. Their product was the first man-made abrasive. The second development was due to Charles B. Jacons in 1897 who produced aluminium-oxide crystals of abrasive quality. In 1911, the Carborundum Company, Limited, was set up to sell the products and the Trafford Park factory was built. Refractories later came into the products of the company. The programme of celebrations has included a special concert by the Hallé Orchestra in Manchester, and on October 3, Dr. J. Bronowski will lecture on the company's behalf on "The Year 2.000" in Manchester. The annual meetings of the Amateur Athletic Association at the White City in London in July will be held in association with the company, as part of the celebrations.

Delta Metal's Export Drive

Mr. W. J. Vaughton, deputy managing director of the Delta Metal Company, Limited, Birmingham and London, and managing director of James Booth Aluminium Company, Limited, Birmingham, flew last week to Rio de Janeiro (Brazil) on the first leg of a world tour of 11 countries. He will visit Brazil, Peru, Venezuela, Canada, United States, Japan, Hong Kong, Thailand, India, Kenya and South Africa.

The Delta Metal Company is the parent company of the Delta group, now claimed to be one of Europe's largest producers of wrought and cast non-ferrous metals and alloys. The products produced by the 35 different companies in the group cover a wide range. Mr. Vaughton comments, "I will discuss plastic pipes in Rio, ball valves in Lima, metal fabrication for ships in Tokyo, cutlery and brass rods in Hong Kong and a host of different items in United States and Canada. If there is time, I hope to see the Delta stand at the Canadian Production Show." The stand is the largest in the joint display by the Board of Trade and Birmingham Engineering Centre at the Toronto exhibition which opens on May 8.

ECGD Changes

The Export Credits Guarantee Department announces the establishment of a new division to deal with the "Export Finance Guarantees" recently announced by the President of the Board of Trade. The division will be known as "Financial Guarantees and Policy Division" and will be in the charge of Mr. R. A. Dickinson. Mr. Dickinson's place as director of general division will be taken by Mr. C. P. Rawlings, who will be succeeded by Mr. P. H. Garrity as director of overseas division.

Mr. Dickinson will be assisted by Mr. G. F. B. Corti and Mr. H. G. B. Lynch (principals) and by Mr. F. Greenwood as chief underwriter and Mr. T. F. B. Crossfield as senior underwriter. Mr. E. Edwards will succeed Mr. Greenwood as chief underwriter in special guarantee division; Mr. A. Watson will become chief underwriter in comprehensive guarantee division in place of Mr. Edwards.

SECTION DEVOTED TO THE TECHNOLOGY OF PRODUCING DIMENSIONALLY-ACCURATE CASTINGS

Particle Coating in Investment Moulds . . . . Solid Fluidization Technique*

There are a number of drawbacks to the efficient coating of an investment-mould pattern. To economise on time, to eliminate a great deal of the manual work involved and to achieve a uniform application of the granular particles recourse has been made to the principle of gas/solid fluidization. The following article describes a practical technique that has been evolved, an apparatus for achieving the fluid-particle condition, and concludes with a brief summary of the theoretical basis of the method.

The development of an improved technique for the application of particle coating in the production of investment-casting moulds has led to the use of gas-solid-fluidization. For all practical purposes the fluidization method as developed by Quigley and Deluca appears to present a technique superior to the conventional methods used in investment casting for the application of solid particles to pre-wetted forms.

Conventional Method

As is well-known the initial step in the manufacture of a standard investment-casting mould is the coating of the cleansed pattern with a ceramic slurry and the subsequent coating of this slurry with solid, granular particles. Investment of the resulting form then follows. The more-recently developed processes for the production of an investment-casting mould incorporate the application of multiple, alternate coats of slurry and solid particles to the pattern in the build-up of the relatively-thin-walled mould. The conventional method of solid particle coating is manually or mechanically to direct a stream of particles onto the pre-wetted form by the action of gravity. This method is time consuming and requires an excessive amount of manipulation of the form by the operator. In the case of complex patterns it does not readily yield a uniform particle coating.

New Method

Coating processes which utilize the unit operation of gas-solid fluidization have found wide acceptance by the plastics industry.[1, 2] Solid fluidization is the process of imparting to a particle bed a state of continuous agitation. Gas-solid-fluidization is effected by the passage of a gas up through a bed of solid particles. The bed, in its agitated or fluidized state, behaves in many respects like a liquid. This phenomenon allows the complete immersion of heated forms into a fluidized bed of plastic powder for coating and should allow the complete immersion of wet forms into a fluidized bed for particle coating.

The coating used to accomplish fluidization of a particle bed is very simple in design. A fluid-bed system consists of two chambers separated by a horizontal fluid-diffuse plate. The lower or downstream chamber is a high-pressure chamber provided with the fluid line. The upper or upstream chamber contains the fluid bed. The diffuse plate provides uniform fluid distribution into the upstream chamber. Construction material for the system must be rigid and impermeable to the fluid. Specification of particle size and density, fixed-bed height and porosity, and fluid medium sets minimum values on the operational variables in accordance with the theory of solid fluidization. A brief analysis of solid fluidization theory is presented in the concluding section of this article.

Development

The use of gas-solid-fluidization was considered in devising an improved method for the application of solid, granular particles to a wet form. The unit designed and built for fluidization of a particle bed is shown in Fig. 1. Conventional design was adhered to in the provision for two vertical chambers. The cross-sectional area of each was specified as a rectangle of invariant dimensions. This deviation from conventional fluid-bed design was made in order to permit the downstream chamber to act as a structural base for the unit in addition to its role as a gas reservoir, and to achieve a maximum working volume in the upstream chamber for fixed overall dimensions. Dimensions of the upper chamber were selected so as to provide for the immersion of large pattern assemblies, ease of the immersion operation, and the existence of a volume above the bed to ensure solid streamer recovery† during operation.

* Prepared from a report (RPL 1317) by Francis Quigley and Eugene Deluca for the Office of Technical Services, US Department of Commerce.

† Ejection of solid particle clusters from bed surface occurs during fluidization.

Particle Coating in Investment Moulds

Construction

The height of the downstream chamber is 20 in.; whilst the overall height of the entire unit is 44 in. The unit measures 18 in. by 18 in. in cross section. Construction material for the system is 20 US standard-gauge sheet metal. Although the metal does not satisfy one of the aforementioned criteria—rigidity—its low cost and fabrication ease account for its use. Rigidity of the vertical walls is maintained by the use of strategically-placed tie rods. Selection of a suitable fluid-diffuse plate was made on the basis of availability of certain foundry materials. Plates of resin-bonded sand of thicknesses ¼ in., ½ in. and 1 in. and a 1¼ in. plate of porous refractory brick were formed and evaluated separately. Plate support was provided by an iron grate set on a ¾ in. lip projecting horizontally from the top of the downstream chamber. All plates were sealed into place using ordinary brick mortar. The relative cost, availability, and inertness of compressed-air made it an obvious choice for the fluidizing medium. Alumina particles of average diameters 0.0138 in. and 0.0062 in. and silica particles of 0.0117-in. average diameter were utilized in particle beds of varying fixed-bed height and constant fixed-bed porosity. Each of these three particles is currently used in mould production processes at American foundries.

Results

Complete fluidization of all particle beds was accomplished by use of the porous refractory brick diffuse-plate and a controlled fluid input from a 90 lb. per sq. in. gauge source. In a fluidized-particle bed in operation the porosity of the resin-bonded sand plates proved to be insufficient for the air flow necessary under the given conditions. Long heating periods at 230 deg. C. failed to increase the porosity measurably. Particle coatings of each of the three sizes of particles were applied to all available size and shape variations of pre-wetted patterns by immersion into the fluidized bed. By comparison with the former method, the fluidization technique took but a few seconds of labour. It involved a simple movement of the form, coated all forms rapidly and evenly, and eliminated the possibility of pattern damage by a particle stream. The new method reduced the amount of lost solids, and eliminated atmospheric pollution by dust. In addition, the process equipment is far-less costly than any mechanical unit used for continuous coating. Maintenance of the system merely involves a periodic screening of the particle bed to remove impurities accumulated during operation.

Fluidized systems for particle coating are now operating most successfully at the Watertown Arsenal in the US in the production of standard investment-casting moulds and also in the production of new ceramic-type precision moulds.

Brief Analysis of Theory

This section seeks to provide such material as will answer the basic design questions: (1) What is the minimum longitudinal pressure-drop necessary for fluidization of a given particle bed? (2) What is the minimum superficial-fluid velocity necessary for fluidization of a given particle bed?

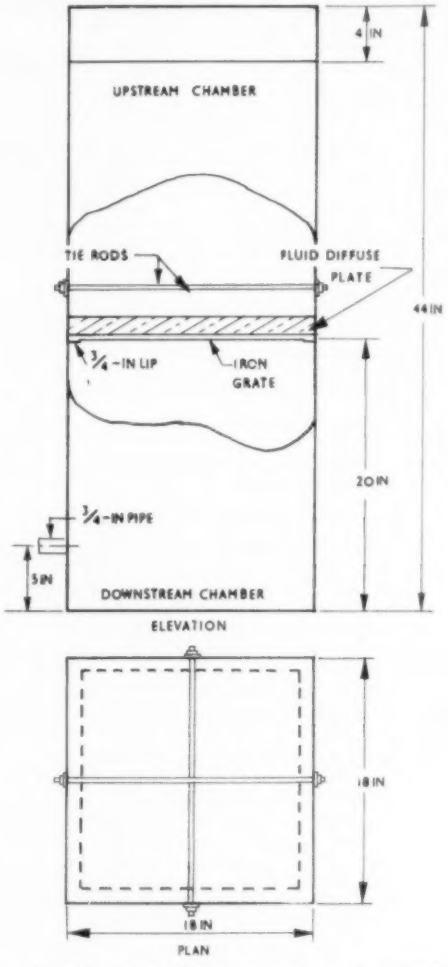

FIG. 1.—*Sketch showing apparataus described in the text.*

In the discussion of solid fluidization, a distinction has to be made between particulate fluidization—fluidization by a liquid—and aggregative fluidization—fluidization by a gas. The latter method is being used.

The passage of a gas up through a vertical bed of solid, granular particles is accompanied by a frictional-pressure-drop. An increase in this longitudinal-pressure-gradient is accompanied by an

increase in gas velocity. The graph shown in Fig. 2 illustrates the variation in the pressure drop with superficial gas velocity for the general case[3]. Point A marks the beginning of fluidization. Beyond this point, fixed-bed operation ceases to exist. Point B is the fluidization point, defined as the point where the antilog of the ordinate is identical to the weight of the particle bed per unit of cross-sectional area less the buoyant force acting on this column of particles. The porosity of the bed commences to increase at A with increasing gas velocity; in theory, it approaches unity as a limit at a velocity corresponding to the terminal free-settling velocity of the particle in the gas medium.

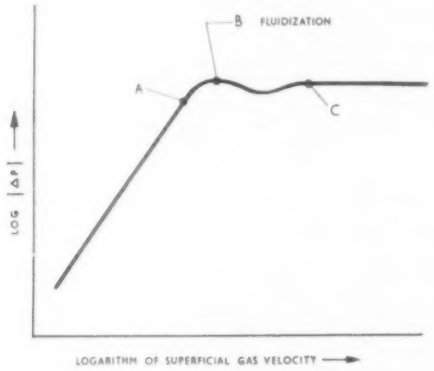

FIG. 2.—*Graph illustrating typical variation of longitudinal pressure-drop with superficial gas velocity.*

At point C all particles are in motion. This point is known as the point of complete fluidization. The longitudinal-pressure-gradient is relatively constant for gas velocities greater than that at point C. An ebullience of gas bubbles breaking at the surface of the bed and causing clusters to emerge from the bed surface begins at point A and increases in intensity with increasing gas velocity. This phenomenon is due in large part to the selection of certain random paths through the bed by relatively large volume slugs of gas. The antilog of the ordinate at the point of fluidization is the magnitude of the necessary-pressure-drop for fluidization of a given particle bed. Its value, based on the definition of the point of fluidization, may be expressed in terms of the bed parameters as:—

$$|\triangle P| = Z\,(1 - F)\,(P_S - P_G)$$

where Z is the height of the fixed particle bed, F is the porosity of the fixed particle bed P_S is the density of the solid particles, and P_G is the density of the gas. Fluidization of a specified system occurs at a superficial-gas-velocity known as the minimum fluidization velocity (velocity at point B in Fig. 2). Experimentation with fluid-bed systems has shown that a criterion for aggregation fluidization is that the Froude number, Fr, exceeds unity[4]. The Froude number, a dimensionless grouping of terms, is expressed as follows:—

$$Fr = \left(\frac{V^2}{g.D}\right)$$

Here V is taken as the fluidization velocity, g is the acceleration of gravity, and D is the average particle diameter, all in consistent units. Based on the aforementioned experiments, charts have been constructed giving the minimum fluidization velocity as a function of the particle diameter[5]. The optimum-gas-velocity, however, is located at point C in Fig. 2, and it is slightly greater than the fluidization velocity.

Acknowledgment

Acknowledgment for permission to publish this survey is due to the Director of the Rodman Laboratory, Watertown Arsenal, Watertown, US. The tests have been carried out by F. Quigley, metallurgist and E. Deluca, chemical engineer.

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New Engineering Course

Details of a new general engineering course for young school-leavers were announced recently by Sir David Eccles, Minister of Education, in a memorandum to local education authorities. The course, which will be introduced into technical colleges in the autumn, is intended for boys aged 15 to 16 who show promise of being able to qualify as technicians. The technical subjects in the syllabus will occupy about 240 hr. per year. The scheme also provides for the inclusion of English and general studies. An important and novel feature is that it provides a common introduction to courses in both mechanical and electrical engineering. Boys who succeed will proceed either to an Ordinary National Certificate course or to one of the various courses for engineering technicians.

This is the first of the general courses foreshadowed in the recent White Paper, "Better Opportunities in Technical Education," as one of several measures intended to increase the supply of qualified technicians to meet the present urgent needs of industry. It has been prepared by a standing committee of technical examining bodies in consultation with the engineering professional institutions. The Minister is confident that technical colleges and local education authorities will make a special effort to ensure that the first year of the new course will be open to students in the coming autumn.

METROPOLITAN-CAMMELL CARRIAGE & WAGON COMPANY, LIMITED—Sir Ralph B. Emmerson becomes chairman in succession to Mr. H. N. Edwards, who resigned from the position on April 30. Mr. Edwards, who has been with the company or its predecessors for 51 years, will continue as a director. Mr. A. H. Hird will join the board in place of Sir James Reid Young.

Notes from the Branches

Lancashire

The Lancashire branch of the Institute of British Foundrymen held its annual general meeting on April 15 when the following officers were elected:—As *president*, Mr. F. Lord; as *senior vice-president*, Mr. G. C. Studley; *junior vice-president* and *hon. secretary*, Mr. H. Buckley; *assistant secretary*, Mr. G. Walker; and *treasurer*, Mr. F. A. Harper. The *auditors*, H. Smethurst and J. J. Harvey, were re-elected. Members elected to the branch Council for three years were Mr. W. Cook, Mr. Collier and Mr. Coates; for two years, Mr. Platt. The three members elected to represent the branch on the IBF General Council for one year were Mr. E. H. Beech, Mr. C. M. G. Wallwork and Mr. R. Yeoman; Mr. G. Southern was elected to be branch representative on the Technical Council.

The business of the meeting being completed, Mr. R. Yeoman proposed a vote of thanks to the retiring officers and congratulated Mr. F. W. Nield, the retiring president, on his leadership over the past year. Mr. Nield suitably replied and thanked all who had helped him during his year in office. He then introduced the president-elect, Mr. F. Lord, and invested him with his chain of office. Mr. Lord, expressing great pleasure at his election, said he would try to maintain the high standards set by previous branch presidents.

"John Wilkinson" Awards

The next item on the programme was the presentation of awards to the winners of the John Wilkinson Medal Competition. The first prize went to Mr. W. Routledge of Darlington Iron Company, Limited; the second and third prizewinners were Mr. Kenneth Pilling (Dobson & Barlow, Limited), and Mr. Bernard Hatton (Harvey & Longstaffe, Limited) respectively. Mr. Ian Perris, of Dobson & Barlow, won the special award for apprentices under 17 years of age. Mr. Routledge who was called upon by the chairman, Mr. Nield, to read his paper, expressed his thanks to the competition organizers and to his employers for the help and encouragement they had given to him.

Next, Mr. G. Southern detailed the year's activities and findings of the Technical Council. He particularly referred to the impact which the proposed introduction of the decimal system into this country would have on the standards evolved by the Council; these he said were to be referred to the International Commission for Standards.

The evening concluded with the showing of two films—"The Automatic Buehrer Moulding and Pouring Plant in the Malleable Ironfoundry of George Fischer, Limited, Switzerland," and "Mechanization and Automation in the Foundry," the latter showing the mass-production of cylinder-liners at the Renault car factory in France.

Northampton Section

The March meeting of the Northampton and district section of the Institute heard two short papers presented by members of the section. Mr. G. W. B. Hanna took for his subject "Problems encountered in Shell Coremaking." Mr. Hanna comes from an automobile foundry producing about 400 tons per week of grey-iron castings including cylinder-blocks and heads and he described some of his experiences when his foundry examined the shell process. The talk was confined to coremaking and Mr. Hanna pointed out that in the experiments he had conducted the idea had been to use the shell process as a substitute for existing oil-sand practice. In the course of his paper, Mr. Hanna pointed out that unexpected difficulties like the bending of a cylindrical shell-core during casting could present a hitherto unknown problem and with the high temperature at which the castings were often poured (1,500 deg. C.), shell cores did not always give the high degree of casting finish for which they were renowned. Consequently, some shell cores had had to be blacked in exactly the same as orthodox cores.

Metallurgical troubles also were not unknown, due to the slower cooling effect of the hollow core and this had necessitated alterations to runner systems and had in some cases given castings of lower Brinell hardness. Whilst it was pointed out that most difficulties could be overcome if studied closely enough, the question of economy was of paramount importance and only certain jobs really lent themselves to manufacture in shells.

"Jobbing and Why"

The second paper was by Mr. H. Edge with the title "Jobbing and Why." Mr. Edge illustrated his talk with a number of coloured slides, making references to a jobbing foundry producing grey-iron castings weighing from a few ounces up to 25 cwt. Apart from grey iron, he also covers aluminium up to 6 cwt. and some bronze, too, at a foundry producing approximately 30 per cent. for use in the home plant.

Mr. Edge's company manufactures rotary-printing presses and the castings are, therefore, fully machined and a good finish without subsurface defects is essential. However, a large amount of this work constitutes very small quantities and consequently pattern and corebox equipment often consists of skeleton frames and templates which are both inexpensive and can be adapted to produce different sizes of machines. This sort of equipment is particularly preferred in the jobbing foundry from the storage point of view because room to store pattern equipment is always at a premium. Mr. Edge explained that he uses CO_2-bonded cores throughout his foundry but adopts greensand moulding for reasons of economy. Mr. Edge's most interesting lecture showed he is a capable foundryman who is giving special attention to running his castings and introducing the metal evenly throughout the mould, with obvious benefits.

Discussion

Following presentation of the papers, a combined discussion took place, this being opened by Mr. Ford who complimented both speakers and Mr. Edge particularly for his ability as a photographer as well as a foundryman. He asked if Mr. Edge besides making cores by the CO_2 Process also used it for moulds. Mr. Edge replied that CO_2 was only used for moulding when the job was tricky and did not give satisfaction in greensand. A greensand mould was the cheapest mould obtainable and with craftsmen and good organization he thought it unnecessary for most jobs to use the more costly CO_2 Proces. Cores in CO_2 were however a different matter—they were not very expensive and possessed many advantages such as dimensional accuracy, speed of cure, they eliminated core oven fumes and the need for carriers. Replying to a question on gating, he said systems were decided by the moulders in conjunction with the foreman and running systems were standardized wherever possible. He explained with regard to camber on large castings, that originally patterns were clamped to two heavy cambered beams to allow for this, but

recently the practice had been discontinued without trouble; he suspected the reason was to be found in the even introduction of metal throughout the castings which thus reduced temperature differentials. He said no trouble had been experienced with CO_2 coresand breakdown at the knockout, but it had been necessary to alter some runners; he felt a good core-wash and the use of well-rammed cores were very important. Asked if he were not likely to be in difficulty with his foundry practice in the years ahead because of shortage of skilled moulders, and also if better patterns and CO_2 moulds were not worthy of consideration for the future, Mr. Edge agreed with the questioner that to obtain skilled men was difficult, and also would certainly keep an open mind in the CO_2 Process.

A member referred to shell core bending and asked if the core could not be strengthened by increasing the resin content of the sand, also what was the behaviour of shell cores in storage. Mr. Hanna agreed that increasing resin content from four to six per cent. would strengthen a core but pointed out that this would make it uneconomical; storage properties of shells were exceptionally good.

Mr. L. F. Stansbie congratulated the section on once again providing their own lecturers for a monthly meeting and stressed the amount of preparation needed for only half-an-hour's talk. Mr. R. C. Sidwell seconded the vote of thanks, adding his own appreciation of an interesting evening on what he described as two "extremes" of foundrywork.

Australia (Victoria)

Mr. G. P. Adams, managing director of Shellmould Pty., Limited, and Mr. H. A. Stephens, foundry sands investigator, CSIRO, who both visited the UK last year for the Institute's annual conference at Malvern, gave in a paper to the March meeting of the Australia (Victoria) branch their "Overseas Impressions" of foundry operations, shell-moulding trends and research work in the United States and England. It will be remembered that Mr. Stephens presented a paper to the IBF conference on moulding-sand practice in the Australian foundry industry.

Sheffield

The annual spring social evening of the Sheffield branch was held at Brincliffe Hall on Friday, April 14; as usual, this informal function was well attended and was acclaimed a great success. Dancing to Hal Baker and his Orchestra was from 8 p.m. to 1 a.m. During the course of the evening, guests having lucky numbers received from the president's wife, Mrs. J. H. Pearce, gifts kindly donated by friends of the industry and members of the branch Council.

London Branch "Men Only" Dinner

Records were broken again at this year's annualtion being a little strained to take the almost 100-"Men Only" function of the London branch of themember increase on last year. All concerned with the Institute of British Foundrymen. Nearly 300 attendedorganization, particularly Mr. W. R. Buxton, honorary Lyons' Corner House in Tottenham Court Road for asocial secretary, can take credit for the increasing dinner and cabaret show on April 21 with Mr. D. A. C.popularity of the function and no doubt some was also Hutchison, the branch president, in the chair. Thedue to the attractions of a floorshow which was picture shows a part of the gathering, the accommoda-"lively"—to say the least!

Personal

Dr. A. W. HENDERSON has been appointed chief metallurgist of the Plessey Company, Limited.

Mr. A. R. ROBERTSON has been appointed registrar of the United Steel Companies, Limited, Sheffield.

Mr. W. N. MENZIES-WILSON has been elected a director of the Stanton Ironworks Company, Limited, near Nottingham.

Mr. ALAN DAWSON has been appointed truck sales manager, car and truck domestic sales division of the Ford Motor Company, Limited.

Mr. T. RICHMOND has been appointed to the board of the Titanic Steel Company, Limited, a subsidiary of Samuel Osborn & Company, Limited.

Newly-elected president of the Institution of Plant Engineers, Mr. G. D. JORDAN, is, at the age of 36, the youngest president in the history of the Institution.

Mr. F. ALLCOCK, chief engineer with the Doncaster firm of brassfounders, Peglers, Limited, has been elected vice-president of Doncaster Engineering Society.

Mr. C. E. HUTCHISON has been appointed general sales manager of Sheepbridge Equipment, Limited, Chesterfield, a member of the Sheepbridge Engineering group.

Mr. J. C. MCVEIGH, M.A., M.SC., A.M.I.MECH.E., has been appointed principal lecturer in the department of mechanical engineering, at the Borough Polytechnic, London, S.E.1.

Mr. D. H. BYLES, of Baker Perkins, Limited, Peterborough, has been appointed a director of Packman Machinery, Limited, a subsidiary company of the Baker Perkins group.

Mr. P. J. PRIOR has been appointed to the board of the British Aluminium Company, Limited, with effect from May 1; he took up his duties as financial director on that date.

Sir ARTHUR VERE HARVEY, C.B.E., M.P., managing director of CIBA United Kingdom, Limited, the holding company for CIBA interests in the UK, has been appointed to the board of the parent company in Basle.

Mr. H. F. HOWELL has been elected chairman of the West Midlands branch of the Institution of Agricultural Engineers in succession to Mr. H. R. SMITH at the annual meeting of the Institution held at Warwick.

Dr. R. A. GREGORY, joint managing director of Midland Silicones, Limited, has been appointed to a new position with the parent company, Albright & Wilson, Limited, as head of the inter-company planning department.

Wing-Commander JOHN M. AITON, chairman and managing director of Aiton & Company, Limited, pipe engineers of Stores Road, Derby, has been re-elected president of Derby and Derbyshire Chamber of Commerce.

Mr. BERNARD GITTENS has been appointed a director of Matterson, Huxley & Watson (Sales), Limited, Hales Street, Coventry. The company's foundry which was erected in the eighteenth century was destroyed in the "blitz" of 1940.

Mr. J. C. CHILDS, who has been appointed works manager of Sheepbridge Stokes, Limited, Chesterfield, a member company of the Sheepbridge Engineering group, was previously with an associate company, Sheepbridge Alloy Castings, Limited, as methods engineer.

Mr. G. G. THOMPSON has been appointed a director of the Birmingham Chemical Company, Limited. He is on the board of the parent company, Staveley Industries, Limited, and managing director of British Soda Sandbach, Limited, another member of the group.

Mr. H. K. HARTLEY, has been appointed general sales manager of Fawcett Preston & Company, Limited, a member of the Metal Industries group. Mr. Hartley who has been with the company since 1940, was previously sales manager of the rubber and plastics division.

Mr. D. R. TAYLOR, assistant works manager at the Carriage and Wagon Works at Shildon, has been appointed works manager at the York Carriage and Wagon Works. He entered the railway service in 1937 as an apprentice at the Darlington North Road Locomotive Works.

New export manager of Geo. Salter & Company, Limited, West Bromwich, spring and weighing-machine makers, is Mr. D. J. ANELLI, formerly export office manager of the company. Mr. Anelli replaces Mr. C. J. P. TURNBULL who has left Salter's to take up another appointment.

Mr. HUGH WEEKS, who was specially appointed a member of the Economic Planning Board by the Chancellor of the Exchequer in 1959, has been appointed a director of Hadfields, Limited, Sheffield. He is deputy chairman of Truscon, Limited, and a director of the Finance Corporation for Industry.

For the past 14 years works manager of Frederick Town & Company, Limited, the Halifax machine-tool manufacturers, Mr. JAMES WILLIAM KIDDLE has retired. He served his apprenticeship with William Asquith Limited, later became a foreman with Kitchen & Wade, Limited, and joined Town's as a fitter in 1925.

Mr. GERARD YOUNG, chairman of the Tempered Group, Limited, Sheffield, has returned from a three-week business visit to the United States and Canada. His itinerary, largely concerned with the appointment of distributors for products of the group, included New York, Chicago, Detroit, Pittsburg, Montreal and Toronto.

Mr. R. B. HESSELDEN, works manager of the Holset Engineering Company, Limited, since its formation in 1952, has been appointed a director of the company. Mr. R. BARR who succeeds Mr. Hesselden was formerly assistant works manager. The Holset company is associated with W. C. Holmes & Company, Limited, Huddersfield.

To mark his 50 years with the firm of George Hattersley & Sons, Limited, loom makers, North Brook Works, Keighley, Col. F. LONGDEN SMITH, head of the firm, was presented at a staff dinner with an inscribed silver salver from members of the staff. Col. Smith succeeded his brother, the late Mr. H. Giffard Smith, as chairman of directors last year.

Mr. W. PERCY MCGEOCH, deputy chairman and joint managing director of William McGeoch & Company, Limited, of Birmingham, manufacturing electrical engineers and brassfounders, has been appointed president of the National Brassfounders Association. Mr. McGeoch's company has been active in the Association since its early days and his father, Mr. William McGeoch, was president in 1930. For many years Mr. McGeoch has served on the Council of the Association and has been chairman of the Midlands branch, honorary treasurer and senior vice-president. He is also chairman of Verity's (Maxlume), Limited, and Verity's (Switchgear), Limited.

"Export, or pack your Bags"

That not only foundry and heavy-engineering industries are alive to the need to export more is shown by the report below of a meeting of British hand-tool manufacturers. A special effort by members to break into the less-traditional markets, was urged by Mr. J. Hugh Neill, president of the Federation of British Hand Tool Manufacturers, when he spoke at the luncheon following the annual meeting of the Light Edge Tool and Allied Trades Association recently. Mr. Neill, who is deputy chairman of James Neill & Company (Sheffield), Limited, a member of the Export Council for Europe, and a former Master Cutler, said that the traditional markets were by no means dependable any more.

Only that week, said Mr. Neill, his company had learned that a traditional market had imposed without warning, a duty of 22½ per cent. on a product previously admitted free. The annual export of his company of that product was worth nearly £20,000. "It is, therefore, well worth exploring the possibilities on the one hand, of some of the smaller and yet-to-be-developed markets, and on the other hand, of the fully-developed markets such as Europe and North America," he added. Mr. Neill said that the probability had to be faced that the fully developed countries would progressively lower their tariff barriers, either to all comers (as the result of GATT negotiations), or to fellow members of a "club" (such as the Six Club, the Seven Club, and the South American Club).

He went on to say, "We must expect to face foreign competition with decreasing protection to assist us, and we should prepare therefore to carry the fight into the 'enemy's' camp. Whatever the problems, the sooner we start to do so, the better. Determination and patience will be needed, but it can be done. If it cannot, we might just as well start packing our bags."

He asks that firms that already were export conscious, should nevertheless, heed the Government's exhortations to export more. "No one of us is perfect," he said. "We can all do better. And those of us who are already doing quite well, who already have an entree, who already have export experience, we are the very people who would find it easiest to improve and who would stand to gain the most."

Scottish Engineers & Shipbuilders

Mr. Iain M. Stewart, chairman of Thermotank, Limited, Glasgow, has been elected president of the Institution of Engineers & Shipbuilders in Scotland. He takes over in October from Mr. John Brown, managing director of John Brown & Company (Clydebank), Limited.

Mr. S. W. Bolwell, principal surveyor of ships' plans, Lloyd's Register of Shipping, and Mr. A. R. Mitchell, a director of Yarrow & Company, Limited, Glasgow, have been elected vice-presidents. Mr. A. N. Brown, director and secretary of John Brown & Company, Limited, becomes associate councillor.

The following have been elected members of the Council of the Institution for 1961-64:—Mr. J. W. Atwell, managing director of G. & J. Weir, Limited, Glasgow; Mr. I. C. Bridge, head of the Department of Naval Architecture at the Royal College of Science & Technology, Glasgow; Mr. J. A. Campbell-Brown, managing director, Blythswood Shipbuilding Company, Limited, Glasgow; Dr. A. W. Davis, departmental manager, Fairfield Shipbuilding & Engineering Company, Limited, Glasgow; and Mr. C. C. Mitchell, director of research and technical development, Brown Brothers & Company, Limited, Edinburgh.

Long Service at Hunt Bros.

At a dinner held at Dudley, Worcs. in mid-April, no fewer than 55 employees of the heavy engineering and ironfounding firm of Hunt Bros. (Oldbury) Limited, Griffin Foundry, Oldbury, were presented with an inscribed gold watch to commemorate at least 20 years' unbroken service with the company. Of this number, 16 had served the company for 35 years and over, and seven had given over 40 years' loyal service, the whole making a record of which the firm is very proud.

Mr. T. G. Hunt, chairman and managing director, in making the presentation, said that the number receiving the award represented about one-third of the number employed by the company, and he felt that this was a good record. An aim of the company was to give men regular employment, and he was glad that so many were now being rewarded for their continuous service. In addition, monetary award was being made to 28 employees with over 25 years' service, and the chairman expressed a hope that many more would qualify for this award in the future.

Mr. Hunt said that although the company had expanded considerably it had not grown too large to lose its personal touch, and for this reason the good relations which existed between the management and employees should continue.

Mr. G. H. Mercer, director, then presented Mr. T. G. Hunt, chairman and managing director with a gold watch for over 41 years' service.

It was announced that the company had decided to "contract in" to the new Government Graduated Pension Scheme, but this would be supplemented by the firm's own non-contributory pension and life assurance scheme which had been in existence for many years.

The Griffin Foundry was established in 1839, and specializes in heavy engineering castings up to 48 tons in weight, and also undertakes complete machining and assembly of heavy and light castings.

Air-minded Peterborough Firms

Three Peterborough engineering firms, Baker Perkins Limited, Mitchell Engineering Limited, and Mitchell Construction Company, Limited, have formed a company to operate their executive aircraft from a former R.A.F. airfield near the town. The new company, known as Peterborough and Spalding Aviation, Limited, will provide pilots and operation and maintenance staff for the three aircraft and will also offer services as consultants to other local firms or people wishing to acquire or operate aircraft.

A contract has been signed for the purchase of Spalding airways from Mr. George Clifton and the directors of the new company (which is owned equally by the three engineering firms and Mr. Clifton) are Mr. Roy Mitchell, Mr. Ivor Baker, Mr. D. Morell and Mr. George Clifton (managing).

Mitchell Engineering Limited, has had a private 'plane since 1948 and has had its present De Havilland Dove for some years. Baker Perkins and Mitchell Construction both bought American-built five-seater Piper Aztecs at the end of last year. Until the Peterborough Corporation requires it for housing purposes, the aircraft will continue to be based at Westwood Airfield which adjoins Baker Perkins' works. The aircraft are used daily by employees and important customers of the three companies to travel to airfields throughout the United Kingdom and nearer parts of Europe.

Low-cost Automation

"At a factory producing nuts a girl operated a machine for placing nylon inserts into the nuts. This girl was replaced by two vibratory bowl feeders and the work was carried out automatically. Following the successful use of this machine, 20 further machines were installed and instead of 20 girls being employed, 19 have been found other work, the remaining girl being employed to fill the bowl and the feeders." This was said recently at Liverpool, by Mr. L. Landon Goodman, B.SC.(ENG.), industrial specialist, Electrical Development Association. He was speaking to a meeting of the Merseyside Productivity Association held at the Merseyside and North Wales Electrical Industrial Development Centre at Paradise Street, Liverpool, on "Low-cost Automation."

Mr. Landon Goodman said that the term "Low-cost Automation" had been defined as "a replacement of muscular and mental effort by the use of simple pneumatic, electric, hydraulic and mechanical components in manufacturing and assembly operations." It could result in greater output not only by improving outputs of both men and machines, but also by making use of inherent skills and by allowing a company to obtain experience of simple types of mechanization which would stand it in good stead when it had to re-equip. Though there was a limit to the amount of research that a small firm could undertake, most of them however, could carry out development work which did not involve large expenditure and promised a quick return—it was in these directions that low-cost automation usually had much to offer. There was, he added, wide scope for low-cost automation in most types of industries particularly where large numbers of manual operations were undertaken. A feature of low-cost automation was the use of simple types of equipment which could be employed again and again; a few examples were: air cylinders, solenoids, valves, timers and photo-electric cells.

Midland Industry discusses the "Bulge"

Representatives from Midland firms, trade unions and education authorities attended a meeting in Birmingham on April 19, organized by the Industrial Training Council, to discuss training problems arising from the "bulge" of school-leavers. Mr. F. Vincent Everard, president of the Engineering Employers' Federation and a director of Belliss & Morcom, Limited, said that 600 engineering employers in the Birmingham/Wolverhampton/Stafford area had decided to increase the annual number of apprentices in training from 7,000 in 1959 to a permanent total of between 11,000 and 14,000.

The Parliamentary Secretary to the Ministry of Labour, Mr. Peter Thomas, refused to accept a suggestion that the Government should make apprentice training and day-release compulsory. He said that if the Midlands region were to raise its apprentice intake to something like the national level the number taken on by employers would need to rise above the 1960 figure by 2,000 this year and another 1,000 next year.

Mr. P. C. Higgs, a representative of the Amalgamated Engineering Union on the Coventry Youth Employment Committee and a governor of the Lanchester College of Technology, said that Coventry had a totally inadequate number of apprentices. He said that on the basis of the Carr Report recommendation that one in four employees should be apprentices, Coventry ought to have 7,500 apprentices.

Open-hearth Steel Techniques

After maintaining a dominant position in British steel production for over 50 years, the basic open-hearth process has now to face competition from improved pneumatic and electric-furnace processes, and indeed it is doubtful whether the conventional open-hearth method will long remain competitive. This was stated in a paper entitled "Heating and Oxidation in the Basic Open-hearth Furnace," presented last month to the West of Scotland Iron and Steel Institute by Mr. A. Donald, Mr. T. Urie, Mr. D. Hadfield, and Mr. I. M. Mackenzie, of Colvilles, Limited.

The authors pointed out that in view of the very large capital investment in open-hearth furnaces any improvement in the efficiency of operation of the process would be of immediate importance to the industry. They stressed the value of co-ordinating oxidization and heating in the furnace. Failure to achieve this may prolong the working of the charge and so increase production costs, and it may also adversely affect the quality of the steel, increasing subsequent processing costs.

In the course of their paper the authors discussed the possibilities of increasing the rate and improving the control of oxidization and heating in the conventional furnace to expand output and provide consistently good steel-quality. This they concluded was possible if full advantage was taken of all available techniques.

Anglo/Bulgarian Trade

Following negotiations in London with representatives of the Government of Bulgaria, for trade quotas for the 12 months beginning April 1, 1961, new quota lists have been agreed which provide for UK exports to Bulgaria totalling £4,160,000. The lists include most types of machinery and equipment, chemicals, ships and boats, metal manufactures, textile yarns and piece goods. In addition, Bulgaria expects to purchase £4,500,000 of steel and non-ferrous metals, and manufactures.

Quotas have been established for the import of goods from Bulgaria to an estimated value of £4,700,000 including canned tomatoes, fruit and vegetables, butter, canned meat, wooden articles and furniture and carpets. The United Kingdom market will also continue to be open without restriction to other Bulgarian products such as beans, maize, seeds and oils, timber and tobacco.

New Plant for Armstrong Whitworth's Close Works

A Herkules model WS600 grinding machine has been newly installed by Armstrong Whitworth (Metal Industries) Limited, Close Works, Gateshead-on-Tyne 8, for the high-precision finishing of rolls for strip and plate mills. It can grind rolls of up to 42-in. dia. and 20-ft. long. The speed at which a roll can be turned is infinitely variable between four and 32 rpm, and the speed of the 5-in. dia. grinding shaft is infinitely variable between 350 and 830 rpm. The machine is the latest addition to a number of new pieces of plant which have been installed at Close Works. Together with a new roll foundry, opened in February, they have brought the company's roll-output capacity up to 15,000 tons a year. About a third of the company's production is exported to all parts of the world. Last year's exports earned £500,000.

News in Brief

JOHN TAYLOR & COMPANY,, LIMITED, of the Bell Foundry, Loughborough, Leicester, are casting a bell to be hung in the Garrison Church of Dhekelia Camp, Cyprus.

THE GAS COUNCIL announces that supplementary data sheets for the sixth edition of the "Coke Burning Appliances Handbook" are now available from the Coke Department, 1, Grosvenor Place, London, S.W.1.

AUSTRALIAN AMBASSADOR TO CAMBODIA, Mr Francis Stuart, has presented the Cambodian leader, Prince Norodom Sihanouk, with railway equipment worth over £A500,000. The Australian Government has given the equipment under the Colombo Plan.

THE STANDARD "Thermal testing of domestic solid-fuel-burning appliances with convection," Part 2, "Hood Method," B.S. 3250:Part 2, 1961, has now been published, and copies are available from the British Standards Institution, 2, Park Street, London, W.1; price 7s. 6d.

FOLLOWING THE PLACING of a £400,000 contract for specialized street-cleansing vehicles by the Teheran Municipality with the Leyland group, three engineers from Iran, accompanied by an interpreter, have been studying maintenance and operation of the vehicles at the Leyland works and at the Watford works of Scammell Lorries, Limited.

NINE OFFICERS of the Imperial Defence College, accompanied by the Regional Controller of the Board of Trade (Mr. E. Atherton) and the Deputy Controller (Mr. L. R. Denton), recently visited the Park Works, Huddersfield, of David Brown Industries, Limited. They were shown round the works by executives of the company and later were entertained to lunch.

A PARTY OF 80 MEMBERS of the East Midlands Association of the Institution of Civil Engineers recently visited the works of the Stanton Ironworks Company, Limited, near Nottingham, when they were shown large diameter spun-iron pipes in course of manufacture and the production of pre-stressed concrete pressure pipes. One of the company's mechanized foundries was also visited.

THREE MEMBERS OF THE STAFF of Stanley Works (G.B.), Limited, tool manufacturers, Sheffield, recently left for the United States where they will have discussions with executives of the parent company in New Britain, Connecticut. They are Mr. Arthur Jones, general works manager, Mr. William Mills, general sales manager and Mr. Hugh Duncombe, production engineer.

ENGLISH STEEL CASTINGS CORPORATION, LIMITED, Sheffield, has completed an order for five cast-steel two-wheel bogie frames which are to be fitted to coaches of the well-known Talgo express in Spain. The castings were made at the Corporation's Grimesthorpe foundry and were subject to several intricate machining operations at the Hawke Street machine-shop before being despatched.

TWO US COMPANIES now producing bauxite in Jamaica have been awarded contracts to supply the US Government with 1,000,000 tons of ore in the next half-year, for its strategic stockpile. Reynolds Jamaica Mines will supply 600,000 tons, and Kaiser Bauxite 400,000 tons. Kaiser Bauxite has increased production to full capacity, and has re-employed 200 people, dismissed in December.

A. E. HARRISON (SCRAP METALS), LIMITED, has been formed with £10,000 capital to carry on the business of scrap merchants etc. Directors are: Mr. Albert E. Harrison, senior, and Mrs. Mona Harrison, both of 1, Alexandra Road, Balby, Doncaster, and Mr. Horace Harrison, 51, Alexandra Road, Balby (directors of A. E. Harrison (Haulage), Limited). Office: 1, Alexandra Road, Balby.

SCIENTISTS from the United Kingdom, USA, Canada, USSR, France, Belgium, Sweden, and Israel, who visited the coating division of F. W. Berk & Company, Limited, during the first International Congress on Metallic Corrosion were shown *inter alia*, one of the largest shotblasting chambers in Europe. The delegates were welcomed by Mr. C. H. Tanner, chairman of the company, and Mr. F. A. Rivett, a director.

AN EXHIBITION on technical training at the Royal Exchange in the City of London is to be held during Commonwealth Technical Training Week, May 29 to June 3. The exhibition will include a display provided by the City Livery Companies in which examples of superb craftsmanship and items of historic interest will be featured. There will also be exhibits from some of the biggest industrial and professional bodies in Britain.

THE DONCASTER FACTORY of the Ford Motor Company, Limited, report an all-time record for the works since short-time working was abolished a few weeks ago. Production has reached nearly 300 vehicles a day—about 30 to 40 more than at the corresponding period last year. Employees are working overtime during the week and on Saturday mornings. The increase in production is mainly in the manufacture of Ford Populars.

A RESIDENTIAL COURSE on "Foundry Supervision" has been arranged by the training committee of the Council of Ironfoundry Associations to take place at the Mount Hotel, Tettenhall Wood, near Wolverhampton, Staffs, from the afternoon of Monday, June 5, to the following Friday afternoon (June 9). The fee for the course is £17 17s. Further information may be obtained from the training section of the CFA, 14, Pall Mall, London, S.W.1.

SHEFFIELD UNEMPLOYMENT FIGURE remains at 0.6 per cent. compared with 1.6 average throughout the nation and the region, it was reported to Sheffield and District Employment Committee in April 11. There had been a slight rise in unemployed of 42, making a figure of 1,719 in a total insured population of 279,393. Of the 1,800 boys and girls who left school at Easter half had been found work, and it was known that a number of the others would return to stay on at school.

MORGANITE EXPORTS, LIMITED, a member of the Morgan Crucible group, will be exhibiting a range of the group's products on stand No. 20 at the National Industrial Production Show to be held in Toronto from May 8 to 12. Demonstrations will be given of a muffle-type electric furnace, fitted with Crusilite silicon carbide heating elements, and other products on display will include recrystallized alumina refractories, heavy-duty resistors, brush holders and Morganite carbon components.

THE YORKSHIRE AND NORTH EASTERN ENGINEERS' BUYERS' and Representatives' Association held their annual dinner at the Kenwood Hall, Sheffield, last month, when there were more than 200 guests from all parts of the country, under the chairmanship of Mr. R. R. Wyatt. Guests included Mr. P. J. Hoare, president of Sheffield Junior Chamber of Commerce, Major P. D. Matterson, chairman, Lancashire branch; Mr. A. C. Billingham, chairman, national Council for the Association; and Mr. M. W. Butler, chairman of Sheffield Round Table.

News in Brief

WALMSLEYS (BURY), LIMITED, manufacturers of paper-making machinery, have received an order valued at more than £3,000,000 from the Soviet Union. The contract, negotiated with representatives of the Moscow agency V/O Techmashimport, is for the supply of four high-speed machines to make tissue paper, each with a trim width of 165 in. The machines will be complete with stock-preparation plants and will be delivered during 1962 and 1963 for installation in three Soviet mills. The USSR has previously bought paper-making machinery from the firm in 1932 and 1938.

WALLACETOWN ENGINEERING COMPANY, LIMITED, Viewfield Road, Ayr, has recently extended its works to a new 14,000 sq. ft. site at Heathfield. The company, founded at Ayr in 1919, is today one of the leading manufacturers of flameproof switch- and control-gear for underground use in the mining industry, and is also extensively concerned with the manufacture of motor control gear for use in the iron and steel industry. It employs about 350 people. A contract, worth £110,000, now being completed by the company is for the National Coal Development Association of India.

AN ORDER has been received by Honeywell Controls, Limited, London, from the Continuous Casting Company, Limited, for the complete instrumentation of a twin-strand continuous casting machine to be installed at the Abbey Works of the Steel Company of Wales. The machine will be instrumented by a new integrated two-wire electric system which will control and record flow of cooling water and lubricant at various points, and monitor certain local flows; it will record and integrate the casting speed and record temperature rises across the moulds. Provision is made for a data handling unit to be fitted later.

THE NEWLY-EXTENDED FACTORY at Beverley, Yorkshire, of the Deans and Light Alloys Division of the Manganese & Brass Company, Limited, was toured by more than 200 industrialists, civic and other guests during an "At Home" on April 22. The aluminium foundry is claimed to be one of the largest in the North of England British Railways are completing the removal of the contents of the Willesden, London, factory of Light Alloys, Limited, to the Beverley factory. The London firm has merged with the old-established Beverley firm of Deans & Sons, Limited, to form the manganese group's new division.

NEGOTIATIONS HAVE BEEN COMPLETED for Austin Crompton Parkinson Electric Vehicles, Limited, Morrison Works, South Wigston, near Leicester, to take over the entire electric-vehicle business of T. H. Lewis, Limited, of Watford. The take-over arrangements are expected to be completed by June 1 and provide for the continued production of the Electruk Rider and the Electruk pedestrian-controlled vehicle in their present form, and the full availability of spare parts for both models. Both companies have emphasised that every effort will be made to avoid inconvenience to those who have orders on hand for these vehicles.

A TOUR OF THE NEW ALFA-ROMEO FACTORY at Milan and a week's holiday on the Italian Riviera will be the first prize in a national essay contest promoted by Production-Engineering, Limited, Glasgow, as part of Commonwealth Technical Training Week in May. Books and drawing instruments will be given to the second and third prize winners. The contest was limited to apprentices in their final year of study for a Higher National Certificate or Higher National Diploma in production engineering. Entrants had to submit an essay of not more than 600 words on "Layout and Design of the Modern Engineering Factory."

T. S. HARRISON & SONS, LIMITED, machine-tool manufacturers, Heckmondwike, Yorkshire, have received an order worth £150,000 for 350 lathes for the metalwork industry of West Germany. The order, received through the firm's agents in Western Germany, is for delivery next year. The company, a subsidiary of the Brooke Tool Manufacturing Company, Limited, of Birmingham, is extending its work at Heckmondwike. They have already received a £50,000 order from West Germany for delivery this year, and recently announced a £40,000 order for 80 lathes placed by a United States organization in London on behalf of their American associates.

ACCORDING to *India News* India currently produces 150,000 *tonnes* of steel structures, 58,200 *tonnes* of steel pipes and tubes, and 5,600 railway wagons. The production of finished machinery and equipment in 1960 included sugar mill machinery worth £2,400,000, jute mill machinery worth over £1,500,000, agricultural machinery worth nearly £1,500,000 and complete machine-tools worth nearly £4,275,000. In addition India produces 52,000 diesel engines, 51,700 automobiles, 295,000 sewing machines, 678,000 horse power of electric motors and 1,329,000 kva. of power transformers, 18,000 tons of aluminium and about 9,000 tons of copper. More than 97,000 tons of ferro-manganese and some quantities of lead and antimony are also produced.

"UNLESS IT IS RECOGNISED by both sides of industry that productivity is a mutual exercise for the mutual good we shall never get anywhere," said Mr. Harry Douglass at a meeting in Dudley. Mr. Douglass, general secretary of the Iron and Steel Trades Confederation and deputy chairman of the British Productivity Council, was addressing members of Dudley and District Productivity Association and trade union representatives on trade union participation in productivity improvement. "I am selfish, I will admit it," he said. "I want more money for the men I represent and the only way I can get it is through increased productivity. If in turn the employer expects to get better dividends can I blame him? This is mutual benefit." Personal contact between management and man was important because he said he had found that most men went on strike against a vague and shadowy thing they called "the employer."

Obituary

The death has occurred at the age of 53 of Mr. GEORGE HARDMAN, managing director of Textile Machinery Makers, Limited, of Oldham.

The death is reported after a short illness of Mr. CECIL AMBROSE LLOYD, at the age of 90. He was for 33 years a director of Stewarts and Lloyds, Limited.

The death occurred on April 10 at Coronada Beach, California, of Mr. E. E. THUM, director of editorial services of the American Society for Metals. He was aged 76.

The death has occurred at the age of 71 of Mr. JOHN HENRY BATES, prior to his retirement in 1957 senior partner of Henry Bates & Son, Witton Foundry, Northwich (Cheshire).

Mr. WILFRED TOOLE, who has died at the age of 75, was the former proprietor of the Star Ironworks, Middleton Road, Oldham. A son of the founder of the business, the late Mr. Joseph Toole, he disposed of his interest in the firm in 1945.

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Raw Material Markets

Iron and Steel

The blast furnaces now in production continue to provide all consumers of pig-iron with adequate supplies, and deliveries could be increased if demand warranted. The furnaces are well provided with raw materials and hold good stocks of iron ore and coke. The steelworks continue to absorb large tonnages of basic pig-iron, and in some areas this has recently been on an expanding scale. Overall productive capacity of this pig-iron, which is being supplied from about three-quarters of all furnaces now in blast, is sufficient to provide increased supplies when required.

The ironfoundries also have no difficulty in acquiring all the supplies of pig-iron they need, and deliveries are made to suit requirements, either from stock or current production. One or two brands of low-phosphorus irons and hematite continue restricted in supply, due to limited production, but other brands of equal analysis and quality are available.

Many ironfoundries continue to obtain substantial outputs, those producing high-duty castings being the most favourably employed, and the demand from the engineering and speciality foundries is well maintained. From the motor vehicle industry recent calls have increased, and most of the supplying foundries are well occupied on a full working week, as are many other units producing high quality castings for other industries.

Most of the light foundries could undertake more work. The call for castings from the domestic utensil trades is on a fluctuating scale, and although some improvement in demand has been reported from some sections of the trade, business is not sufficient to keep plants fully occupied. From the building trades the call for castings is strong. The jobbing and textile foundries are fairly well engaged, but could undertake increased business.

In some areas the supply of scrap to the foundries, particularly heavy machinery scrap is scarce, and insufficient to satisfy demands. Foundry coke, ganister, limestone and firebricks are delivered to requirements.

Many of the re-rollers continue to obtain reasonably good outputs of small bars and light sections, but generally they are not heavily committed on account of the reduced amount of business. The demand for strip and bright drawn bars is also well below previous levels, but for reinforcing rods and bars the heavy demand is sustained. Most of the re-rollers have fairly good stocks of mild steel billets, including a fair proportion of imported material, and for this reason demands from home steelworks are small and fall much below tonnages available. The re-rollers continue to take up from the steelworks all arisings of suitable defectives and crops.

Non-ferrous Metals

Copper markets on both sides of the Atlantic are active and show more life than for some time. The main reason is the rise in the New York futures prices above 30 cents a pound which compares with the spot price of 29 cents a pound. A rise in the US producers price is now expected and this has influenced the London market which was in any event steady on events in Africa, good enquiry from the Far East and the London dock strike.

London is steady with demand good and the belief is now growing that the US economy has genuinely turned the corner and that the statistical position of copper will change very quickly for the better.

Tin is still a good market in London and Singapore, but it is only fair in New York where the price has declined to below $1.08 a pound. Demand is steady, but the metal has been available so that prices have fluctuated only narrowly, cash around £842 a ton and three months metal around £850 a ton. It may be that the buffer stock manager is in the market to stabilize prices, but this is only conjecture.

Lead is quietly steady in London at around £68 a ton—its highest point for over five months. The US market is also quiet and the price unchanged at 11 cents a pound.

Zinc is an irregular market in London with the price steady around £84 a ton, and sporadic in New York where the quotation is unchanged at 11½ cents a pound.

Iron and Steel Merchants AGM

At the annual general meeting of the National Federation of Iron and Steel Merchants, held at the Dorchester Hotel, Park Lane, London, W.1, on April 19, Mr. W. H. Lawson, the independent chairman, reported that during the first half of 1960 there had been a strong demand for most products with a slackening in the second half of the year; demand had continued, however, for such products as plates, sections, reinforcing bars and merchant bars. Total production of crude steel for 1960 had been 24,300,000 tons, representing an increase of 20 per cent. over 1959, and 12 per cent. above the previous highest annual production of 1957. The Iron and Steel Board had stated that capital expenditure in 1960 had amounted to £146,000,000, representing an increase of nearly 50 per cent. over 1959.

With regard to exports, Mr. Lawson said that the tonnage of steel exported during 1960 at 4,100,000 ingot tons was a record, and it was hoped this figure would be exceeded in 1961. He disclosed that in a reserved judgment, the Restrictive Trade Practices Court had declared that the fixed price scheme in the agreement covering black bolts and nuts, except for the provisions relating to special quantity discount and orders obtained from Government Departments, was not contrary to the public interest.

In introducing his report, Mr. Lawson referred to the deaths of Mr. H. Basil Darby, Mr. A. J. Ralph and Mr. Vincent E. Upton, all of whom were distinguished members of the Federation's Council; Mr. Darby had been associated with the Federation since its formation in 1938. Mr. Lawson paid tribute to all three who, he said, had been tireless in their efforts on behalf of the merchants. The chairman a lso announced the holding of the eleventh annual meeting of the International Federation of Associations of Steel, Tubes and Metal Merchants, in London from May 10 to 12.

LEE, HOWL & COMPANY, LIMITED, Tipton, Staffs, pump manufacturers, have concluded an agreement with the Webster Electric Company, Racine, Wisconsin, USA, to manufacture the range of Webster oil-burner fuel units, models 1R and 2R, for sale in the UK, Eire, Denmark, Sweden, Norway, South Africa, Australia and New Zealand. The British product (known as the Lee, Howl/Webster fuel injection pump) is being shown at the Engineering, Marine, Welding and Nuclear Energy Exhibition, Olympia, London, on Stand No. 2, Row N, ground floor, National Hall. The Tipton firm are laying down a special plant with shell-moulding equipment for the production of the body casting, and also other special purpose machinery.

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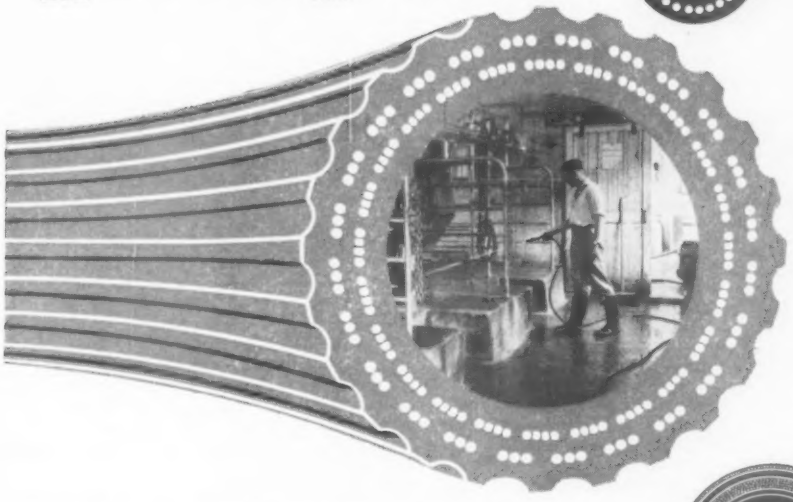

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated)

May 3, 1961

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P 10-ton lots or over, £23 5s. 0d., delivered Birmingham £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d. South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si. £45 0s. 0d. to £48 0s. 0d., scale 15s. 0d. per unit, lumpy. 75 per cent. Si, £62 0s. 0d. to £66 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s.10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 11d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 11d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C,* 1s. 9¾d to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free £275 0s. 0d.; 96/98 per cent., £285 0s.0d.

Ferro-columbium.—65/67 per cent. Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £58 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t.s. 100 tons and over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons and over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C, £40 11s. 0d.; silico-manganese, £43 4 s. 0d

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £235 15s. 0d. to £236 0s. 0d.; three months, £237 0s. 0d. to £237 5s. 0d.; settlement, £236 0s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 3½d. per lb.; rods, 248s. 6d. per cwt. basis; 20 s.w.g., 283s. 6d. per cwt.

Tin.—Cash, £841 10s. 0d. to £842 0s. 0d.; three months £848 0s. 0d. to £849 0s. 0d.; settlement, £842 0s. 0d.

Lead (Refined Pig).—First half May, £66 10s. 0d. to £66 15s. 0d.; first half August, £68 10s. 0d. to £68 2s. 6d.; settlement, £66 15s. 0d.

Zinc.—First half May, £83 2s. 6d. to £83 5s. 0d.; first half August, £83 2s. 6d. to £83 5s. 0d.; settlement, £83 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £121 15s. 0d.; rolled zinc (boiler plates), all English destinations, £120 10s. 0d., zinc oxide (Red Seal); d/d buyers' premises, £97 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10½d. per lb.; sheets to 10 w.g., 203s. 0d. per cwt.; wire, 2s. 8¾d.; rolled metal, 203s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £181; B6, £229.

Brass (High Tensile).—BS1400, HTB1, £199; HTB2 £216; HTB3, £235.

Gunmetal.—BS1400, LG2, £226; LG3, £236; G1, ½%, £298; G1, 1%, £289.

Phosphor Bronze.—BS1400, PB1 (AID released), £316 BS1400, 90/10/1, £305.

Leaded Phosphor Bronze.—BS1400, LPB1, £247.

Phosphor Bronze Strip, etc.—Strip, 294s. 0d. per cwt.; wire, 4s. 2¼d. per lb.; rods, 3s. 4¾d.; tubes, 3s. 4¾d.; chill cast bars, solids 3s. 4½d.; cored 3s. 5½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 11d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £230 0s. 0d. Quicksilver, ex-warehouse, £67 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £250; AB2, £258.

* Average 68-70 per cent.

Latest Foundry Statistics

Steel Castings: The March issue of *Monthly Statistics*, published jointly by the Iron and Steel Board and the British Iron and Steel Federation, records that the average weekly production of steel castings during February was estimated at 6,100 tons. Estimated output for February, 1960, was 6,000 tons, the same figure as for January of this year. The number employed in steelfoundries on February 4 was 18,420, a decrease of 230 since January 7, but 730 more than a year ago.

Copper-base Castings: The current *Bulletin* of the British Bureau of Non-Ferrous Metal Statistics reports that production of copper-base castings during February was 6,800 tons. In the first two months of this year 14,455 tons were produced which is 195 tons more than in the similar period last year.

Record Production of Pig-iron

An eight-year-old blast-furnace at Millom, Cumberland, has produced more than 1,000,000 tons of high-grade hematite pig-iron in a single campaign, of which over 80 per cent. contained 2 per cent. or more of silicon. The furnace, a comparatively small one of 14-ft. hearth diameter and hand-charged, is one of three at the Millom Hematite Ore & Iron Company, Limited's 94-year-old works. The furnace was blown in on April 11, 1953, and was due to be closed down for relining at the end of last month. A new blast-furnace, completed recently at a cost of about £500,000, was lit yesterday (Wednesday) at the works. The Millom Company, one of Britain's largest producers of high-grade hematite pig-iron, owns and operates three hematite ore mines in Cumberland.

SCOW Chief to become Chairman of Lloyds Bank

The chairman of the Steel Company of Wales, Limited, Mr. Harald Peake, is to succeed Sir Oliver Franks as chairman of Lloyds Bank, Limited. Mr. Peake, who is 61, has been chairman of SCOW since 1955 and will give up the chairmanship after the annual general meeting in February, 1962, to enable him to take over as Lloyds Bank chairman that month. At the meeting, Mr. Peake's re-election as an ordinary director of SCOW will be proposed.

In the meantime Mr. Peake, who is also a director of Rolls Royce, Limited, and a member of the boards of a number of insurance and banking houses, will become a deputy chairman of Lloyds Bank jointly with Sir Jeremy Raisman, hitherto sole deputy chairman. Sir Oliver Franks, who has been chairman of Lloyds Bank for the past seven years, is resigning to take up the appointment of provost of Worcester College, Oxford.

Light Alloy Refiners and Smelters

At the third annual general meeting of the Association of Light Alloy Refiners and Smelters Limited, held on April 20, Mr. W. W. Kee (Alcan Enfield Alloys, Limited) was re-elected chairman and Dr. J. Jakobi (International Alloys, Limited) was elected vice-chairman. In addition to Mr. Kee and Mr. Jakobi, the council of management for 1961-62 consists of Mr. F. Farenden (Eyre Smelting Company, Limited); Mr. R. Hahn (B.K.L. Alloys, Limited); Mr. K. R. H. James (Wolverhampton Metal Company, Limited) and Mr. L. A. Jarvis (Wigley Aluminium, Limited).

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Midland 3375/6

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Central 9969

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

839,910. Corning Glass Works, Corning, New York, USA.

Precision casting of metal articles—in particular the manufacture of expendable shell investment moulds or thin-walled one-piece moulds. These are claimed to be composed of ceramic refractory materials and have fine, smooth interior surfaces and accurate internal dimensions.

839,926. Junkerather Gewerkschaft, Junkerath/Eifel, Germany.

Process for chilling surfaces of castings in the mould. The main claim is for the use of chains as cooling bodies for chilling the surfaces of castings. The chains are laid in the mould, in lengths, in contact with one another.

839,991. J. P. Howell, "Rose Lawn," Summerfield, nr. Hartlebury, Worcs.

Manufacture of interlinked articles such as chains, by shell-moulding processes.

840,491. Aluminium Laboratories, Limited, 1800 Sun Life Building, Montreal, 2, Canada.

Metal ingots which are made so as to be stacked to form a bundle which can be transported without being displaced.

840,498. British Iron and Steel Research Association, 11 Park Lane, London, W.1.

An installation for the continuous casting of molten metal. The invention aims at a simpler method for checking the level of the molten metal in the ingot mould For example, it may be desired to keep the level approximately five cm. from the upper edge.

840,516. Clino Foundry Supplies, Limited, 25 Clyde Vale, Forest Hill, London, S.E.23.

Electric-arc furnaces for melting metal for the purpose of making castings.

840,584. Vereingte Leichtmetal-Werke G.m.b.H., Am Nordbahnhof, Bonn, Germany.

A method of casting metal sheets with a thickness above 2 mm. and having longitudinal passageways in them. (See also B.P. 842,476, not abstracted.)

840,608. A.B. Svenska Kullagerfabriken, 17 Artillerigaten, Gothenburg, Sweden.

Improvements in the vacuum casting of metal ingots in a chill mould. The chill has a removable non-porous top part (made of cast iron for example). After the molten metal has cooled sufficiently to form a thin layer of solidified metal against the top, this is replaced by a covering which includes porous thermo-insulating material.

840,645. Ford Motor Company, Limited, 88 Regent Street, London, W.1.

Expendable foundry moulds, *e.g.* resin-bonded sand moulds, having accurately and consistently positioned cores, resulting in cast walls of uniform thickness.

840,668. W. W. Triggs, of the firm of Marks and Clerk (patent agents) for the National Research Corporation, 70 Memorial Drive, Cambridge, 42, Massa., USA.

Arc-melting furnaces with improved safety features.

840,676. John Holroyd & Company, Limited, Holfos Works, Whitehall Street, Rochdale, Lancs.

Continuous casting of rods and tubes using a mould with a tundish-shaped crucible communicating directly with it.

841,043. Minister of Power, London.

Regenerators which can be employed for the exchange of heat—for example to cool high-temperature gases, and at the same time to heat a stream of cooler gas. This has application to the blast gas being fed to a producer or blast furnace.

841,494. Colin Macbeth, 67 Norwich Union Chambers, Congreve Street, Birmingham, 3.

Metal die-casting machines.

Wellman/Incandescent Heat Plans for a Merger

The merger of the Incandescent Heat Company, Limited, and its subsidiaries with the Wellman Smith Owen Engineering Corporation, Limited, group has now taken effect, and although it is the intention that the Incandescent group shall continue to operate as an autonomous unit, the future close co-operation between the two groups should be mutually beneficial, as their products are mainly complementary.

Both construct furnaces for the metallurgical industries, but whereas Wellman specialize more on the larger melting furnaces and oxygen steelmaking processes, including the heavy-duty mechanical equipment, the Incandescent group's activities are, in the main, concentrated on the finishing processes of steel and non-ferrous products such as annealing and heat-treatment furnaces, embodying a wide range of thermal engineering throughout the metallurgical, chemical, foundry, ceramic, and other industries.

In the export field for integrated steel plants, the two companies with their joint resources will be in a position to undertake the whole of the furnace work from steel melting including electric furnaces down to the smallest finishing and heat-treatment units.

House Organs

Mettle, Vol. X, No. 1. Issued by the Marshall Organization, Stafford House, Norfolk Street, London, W.C.2.

This issue records an interview with the chairman of the Marshall organization, Mr. Arnold Carr, on the subject of his impressions of India and Pakistan, where he has been visiting the offices of the company on the sub-Continent. Amongst other favourable comment, he was loud in his praise of the Indian moulder.

The Modern Foundry, Vol. 25, No. 1. Published for Gibson Engineering (Sales), Pty., Limited, Redfern, Sydney, Australia.

An article on the recently-introduced furfuryl alcohol corebinder using hot coreboxes is printed in this issue, and the differentiation between core-shooting and core-blowing is also dealt with.

Alloys and Metals Review, No. 2. Issued by Union Carbide, Limited, 8, Grafton Street, London, W.1.

The foundry article in this issue is on the making of spheroidal-graphite cast iron, using "alloy 55 or 55M"—the latter containing one per cent. cerium-mischmetall.

Cement Special, Vol. 1, No. 2. Issued by Lafarge Aluminous Cement Company, Limited, 73, Brook Street, London, W.1.

This issue contains an article on the use of refractory concretes in foundries, and a further article is promised stressing the use of this material for mould preparation.

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the ADAPTABLE Refractory Material made with crushed firebrick and CIMENT FONDU

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The reduction of joints eliminates displacement troubles.
It is ready for use and of great strength and hardness within 24 hours.
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A.P.57

Company News

G. & J. Weir Holdings, Limited—Though the group net profit fell to £795,993 (£1,256,143) in 1960, the dividend is held at 18 per cent. on the £4,100,000 one-class capital, with an unchanged final of 12 per cent.

Elliott-Automation, Limited—With a final of 8 per cent. for 1960, the dividend is being raised to 13 (9¼ equivalent) per cent. Group profits attributable to Elliott-Automation expanded to £2,269,500 (£1,363,187).

Laurence Scott & Electromotors, Limited—Trading profits fell from £1,122,674 to £872,167 in 1960. The final dividend is maintained at 10 per cent., making an unchanged 15 per cent. total. After tax of £300,000 (£410,000), the net balance is £310,719, against £415,322.

A.P.V. Company, Limited, dairy, brewery, chemical and general engineers, of Crawley (Sussex)—The current year's trading has started satisfactorily and Mr. W. E. Jenkins, the chairman, attributes the improvement in results to an increase of 11 per cent. in group turnover, at £7,100,000, to greater productivity and to increased efficiency in all departments.

Tube Investments, Limited—Interim of 7 per cent. is being paid on £35,431,313 for the year to July 31, 1961. For 1959-60 there was an 8½ per cent. interim on £16,828,702, followed by a final of 9½ per cent. on £35,008,573. The current declaration is intended to eliminate the disparity between payments, and does not imply any increase in the total distribution for the year, it is stated.

Hopkinsons, Limited, bronze, iron and steel founders, of Huddersfield—Group profits for the year to January 31, 1961, amounted to £1,056,792 compared with £1,095,923, and the net balance, after tax, to £544,092 (£575,423). The balance attributable to the company is £539,558 (£570,200). Total dividend is raised by 5 per cent. to 27½ per cent. with a final of 17½ per cent.

Josiah Parkes & Sons, Limited, manufacturers of locks and brassfoundry, of Willenhall (Staffs)—Consolidated profit for the year is increased to £360,158 (£336,447). The chairman, Mr. C. W. Parkes, states that all indications are of a continued high level of demand. He deprecates any tendency towards inflation of price levels as a further handicap in the already hazardous export field.

B. Elliott & Company, Limited, holding company for machine-tool manufacturers, of London, N.W.10—The share capital of Broadway Equipment, Limited, has been acquired. Broadway Equipment is sole licensee for the UK and a number of Commonwealth countries of the French range of brake presses manufactured by Promecam of Paris, and is also sole agent for a number of other foreign machine tools.

Darwins Group, Limited, holding company for manufacturers of high grade steels, castings, magnets, tools, etc., of Sheffield—Trading profits rose from £444,217 to £617,250 in 1960 and the dividend is raised 3½ per cent. to 16 per cent. The final dividend is 10 (8½) per cent., and the year's total is on a capital increased to £1,003,750 by a one-for-four rights issue. After all charges, including tax, there is a net available balance, including that brought in, of £470,462 (£386,901).

Baker Perkins, Limited, engineers, and iron, steel and brass founders, etc., of Peterborough—Group profit, before tax, for 1960 was £1,193,201, compared with £771,526 and a final dividend of 8¼ per cent. is being paid, making 11¼ per cent. for 1960, compared with the equivalent of 8 per cent. for 1959, adjusting for a one-for-four scrip issue. Net profit attributable to Baker Perkins was £530,042 (£417,924). The directors recommend an increase of £2,000,000 in the authorized ordinary capital.

Richard Crittall & Company, Limited, heating, ventilating and air conditioning engineers, of London, W.1.—Mr. G. C. R. Eley, the chairman, states that the company has entered 1961 with a higher forward order-book and, in addition, trading conditions have improved. An extra-ordinary meeting will follow the annual meeting May 19, to consider converting the undertaking into an industrial holding company, called Richard Crittall Holdings, Limited, and to bring the articles up to date.

John Thompson, Limited—Although detailed group figures will not be available until towards the end of May the directors consider holders should know there was a substantial loss incurred in 1960 and consequently they are unlikely to recommend a final dividend. An interim of 5 per cent. was paid last November and a total of 20 per cent. for 1959 included a final of 12½ per cent. The order-book is in a "very healthy state" and in the absence of any unforeseen events, the board believe the group will show encouraging profits in the future.

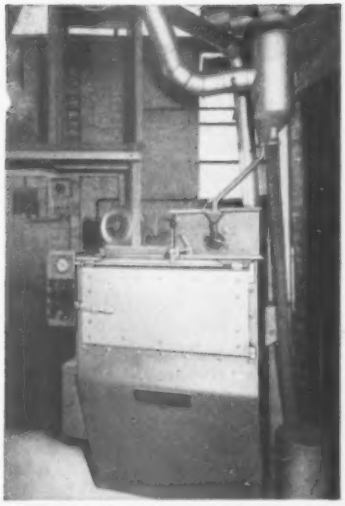
Halesowen Steel Company, Limited—The year to December 31, 1960, started well with a lengthening order-book and a strong demand for the company's products continued until the autumn when the recession in certain industries caused a fall in activity which persisted to the end of the year, states Mr. P. H. Jones, chairman. Trading so far during the current year gives no cause for pessimism. The value of orders is being maintained at a satisfactory level, and there are indications that production will continue at a profitable level, says the chairman.

Catalogues

Wagon Tipplers. An eight-page leaflet, illustrating five types of wagon tipplers, has been received from Henry Lees & Company, Limited, Motherwell, Scotland. Two of the models, for use where shallow excavations only are available, are rope operated, one is a geared-ram end-door tippler, one is a geared-ring type and the fifth a portal type. Where a foundry is sufficiently large, a wagon tippler can be an excellent means of arranging bulk deliveries of sand, coke, etc., in an economical manner and so avoid double handling.

Aluminized Asbestos Cloth. Publication No. AA67, issued by Turner Brothers Asbestos Company, Rochdale, carries a sample of aluminized cloth. Asbestos is the traditional material used for lagging and general insulation purposes, but, it is stated, by facing the material with aluminium foil, there are great improvements possible in the tenacity and heat-resistance of the material, and especially in rendering it vapour-proof.

Bench-assembly Trays and Storage Bins. In publication No. 2/61/RM, Kabi (Electrical & Plastics), Limited, Cranbourne Road, Potters Bar, Middlesex, describe and illustrate plastic containers, ranging from quite small ones for small-component assembly-benches to trolleys containing up to 84 bins for use as mobile component-stores. Boxes which will either nest or stack are featured in the catalogue.



Baker Perkins Foundry Machinery at work ... *at the Southend Engineering Co. Ltd.*

This Baker Perkins Girojet Universal Shot Blasting Machine operates without compressed air, needs negligible maintenance and costs little to run. And here's another advantage—no foundations are needed. The Girojet will take an evenly distributed load of 500 lbs. Average shotblasting times: aluminium (2-4 minutes); grey iron (3-6 minutes); malleable cast iron or bronze (4.5-8 minutes); forged steel or stamped steel (10-20 minutes).

This is the machine that completely replaces the hand cabinet.

Please write for full details today.

Baker Perkins Ltd. ENGINEERS

Bedewell Division, Hebburn-on-Tyne, Co. Durham
Telephone : Jarrow 897124

HISTORICAL NOTE

Southend Engineering Company was established in 1901, and manufactured Marine and Stationary engines until 1914. The Firm has produced its own non-ferrous castings since 1938. They ma ufacture the "Viking 3" Outboard Motor, a set of flame guns for agricultural purposes, and a range of Stern Gear and fittings for marine engine manufacturers.

BP/F10

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: **Twenty words for 10/- (minimum charge) and 4d. per word thereafter. Box numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY MANAGER desires post, representation foundry supply. M.I.B.F. Life in trade, 25 years management. Widely travelled. Well known northern area. Excellent background. Works Met. Sals. etc. Own car and phone. Box FM742, FOUNDRY TRADE JOURNAL.

SALES REPRESENTATIVE, Grey Iron Castings. Rep. now with leading company Midlands producing machine bench and floor castings, desires change. Adaptable. Please reply in confidence, briefly indicating proposition to Box SR721, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE, experienced, with reputable company Midlands specializing high duty castings mainly automobile industry, seeks further opportunity. Confidential replies to Box RE722, FOUNDRY TRADE JOURNAL.

PATTERN and experimental non-ferrous MOULDER seeks situation in experimental or production foundry. Match plates, white metal and light alloy patterns. Sampling, etc. M.I.B.F. London area preferred. Box PA725, FOUNDRY TRADE JOURNAL.

MANCHESTER based consultant and agent willing to consider further AGENCIES iron and steel, plant and supplies. Full technical representation. Expenses and commission. Principals only. Box MB726, FOUNDRY TRADE JOURNAL.

WILL small North-Western firm contact METALLURGIST wishing to use 16 years melting and other practical experience in steel foundry outside the larger organisations. Box WS741, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNICAL EXECUTIVE (42), A.I.M., Engineering and Management Diploma, U.S.A. experience. At present Chief Eng. European project. Thorough knowledge machine tools, mechanised light castings, vacuum/pressure and gravity aluminium. O. & M. and modern management. Wishes permanent position British industry. £2,500 min. Box FT737, FOUNDRY TRADE JOURNAL.

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COMPANY producing sand and silica products to specification requires personnel to take charge of the laboratories controlling production and chemical supplies. The plants are located in the Midlands and South of England. Men aged 25-40, with experience and sound technical education up to degree standard are required. The salary paid will depend on qualifications and experience. The men appointed will be responsible to the central technical department at Redhill, where a period of training is envisaged. Apply to RESEARCH MANAGER, BRITISH INDUSTRIAL SAND LTD., Holmethorpe, Redhill, Surrey.

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also required with knowledge of chemical analysis and general malleable foundry practice. Applicants should be between 21 and 30 years of age.

Please reply giving details of past experience and positions held to our LONDON OFFICE.

Both above positions carry good salaries and five years' contract to men with suitable experience.

London Office Address
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LETTERS OF APPLICATION GIVING FULL DETAILS OF EXPERIENCE, TRAINING, AGE, ETC., SHOULD BE ADDRESSED TO

BOX AO730.
FOUNDRY TRADE JOURNAL

MSL *have been retained to advise on this appointment.*

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FOUNDRY AND SHOT BLAST EQUIPMENT

with good prospects of future promotion, for a company in the Manchester Area engaged mainly in the design and manufacture of foundry equipment. The company, which has been established for over 50 years, is now extending its range of products.

This is a new appointment and the Development Engineer will be responsible for initiating and developing new lines and the work may entail some customer contact and occasional overseas visits.

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In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

MANAGEMENT SELECTION LIMITED
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REPRESENTATIVE, willing to live in the South of Manchester, required by a well known firm of Blacking manufacturers. Applicant, preferably with car, must be young enough to make this a career. Replies please state salary and previous experience. Box RW744, FOUNDRY TRADE JOURNAL.

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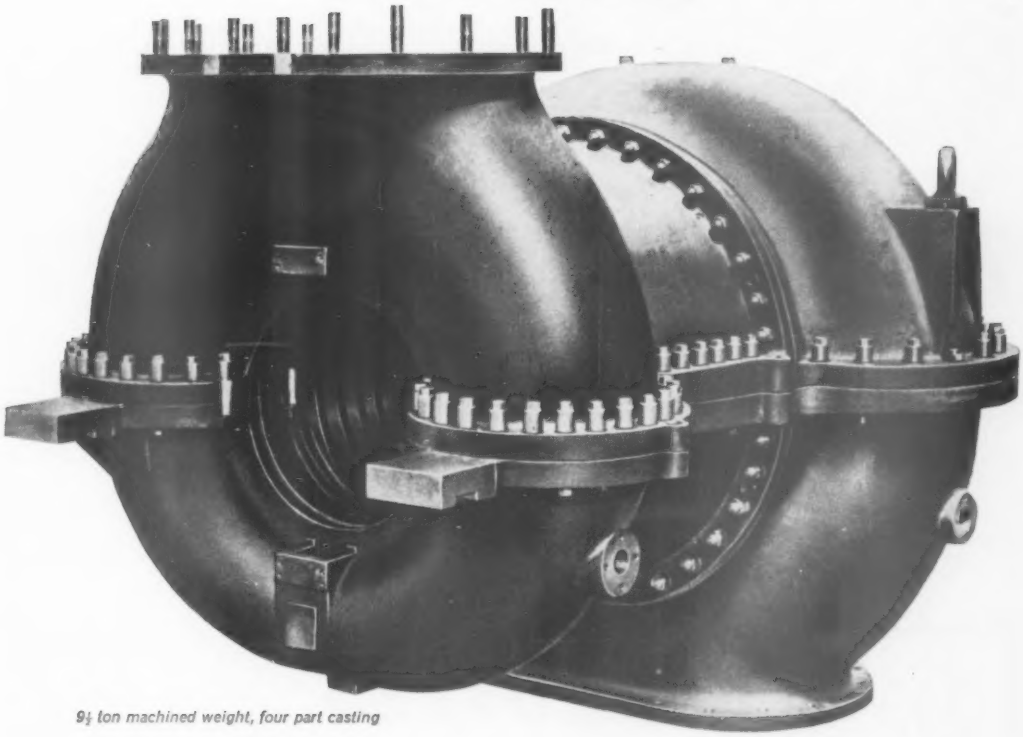

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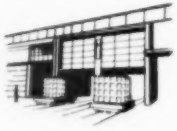

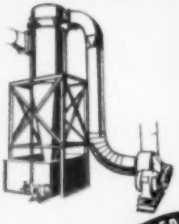

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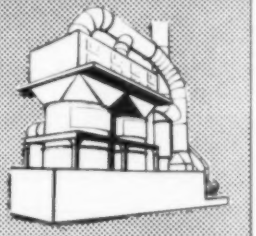

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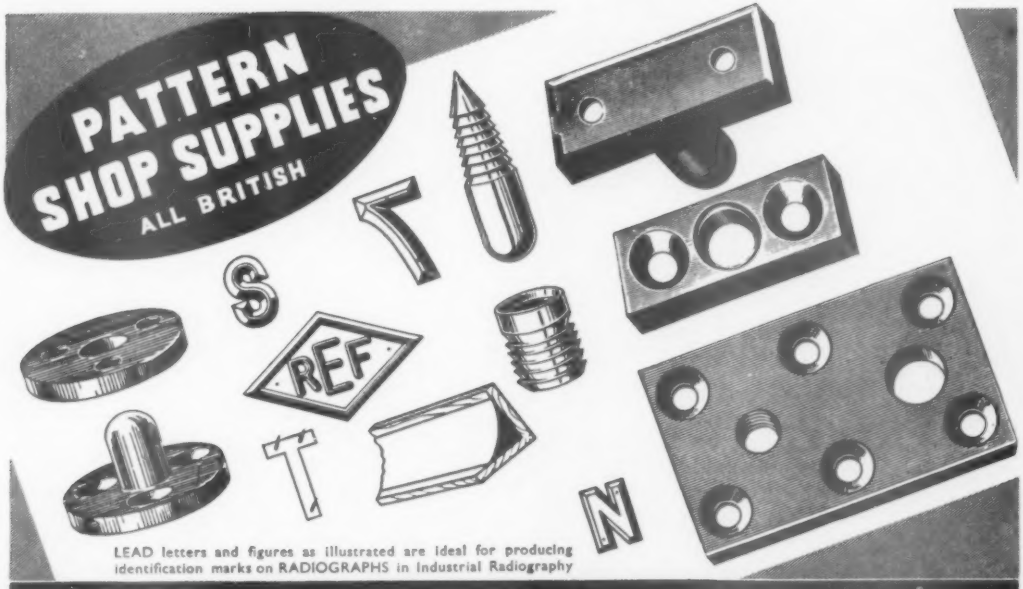

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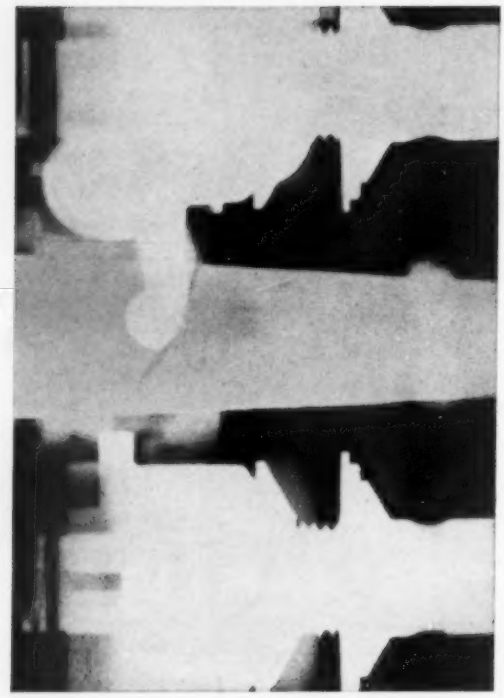

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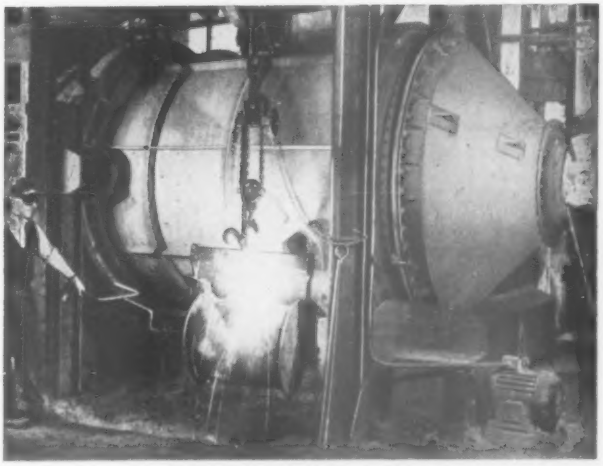

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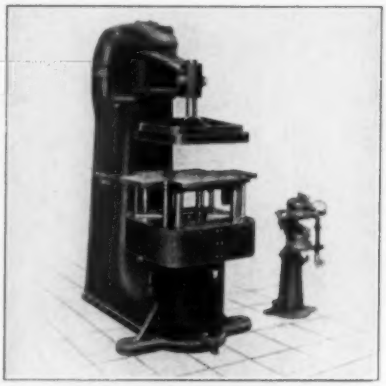

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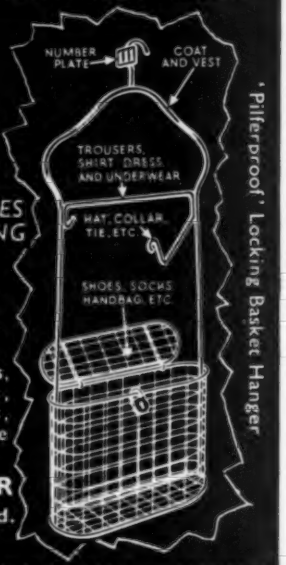

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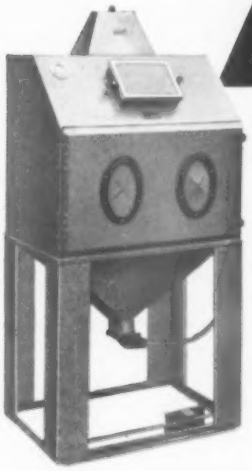

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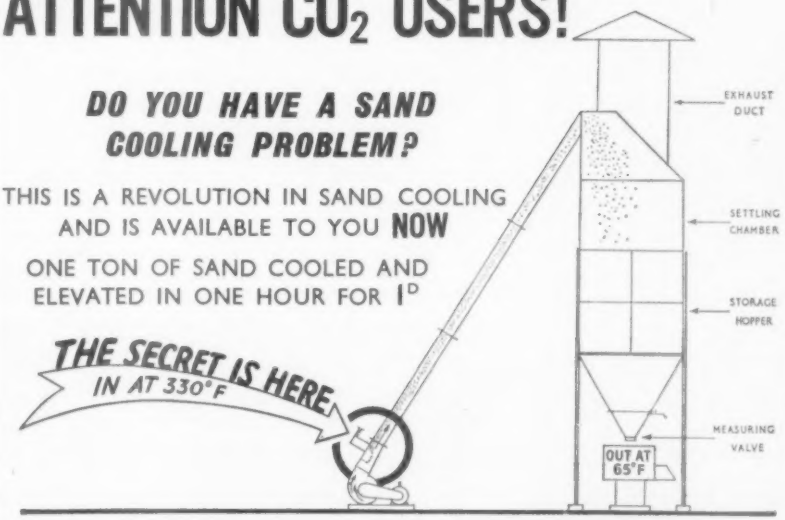

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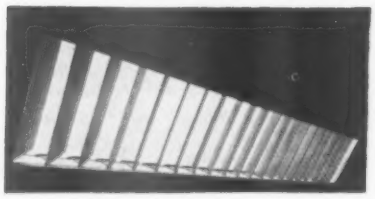

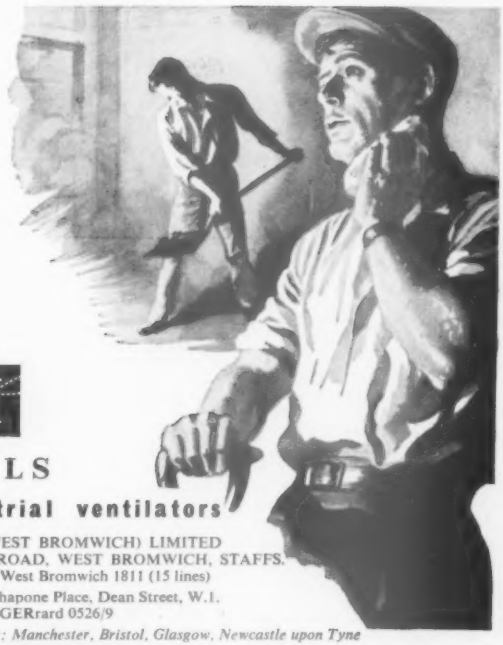

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INDEX TO ADVERTISERS

	PAGE NOS.
A.E.I.-Birlec, Ltd.	—
A.E.I. Plastics (Aldridge) Ltd.	—
Acme Conveyors, Ltd.	—
Air Control Installations Ltd.	—
Albion Pulverising Co. Ltd.	—
Allan, John, & Co. (Glenpark), Ltd.	—
Allen, W. G., & Sons (Tipton), Ltd.	—
Amafond	—
Amber Oils, Ltd.	—
Anderson-Grice Co., Ltd.	—
Annealers, Ltd.	—
Armstrong Whitworth (M.I.), Ltd.	—
Ashworth Ross & Co., Ltd.	—
Aske, Wm., & Co., Ltd.	28
Ass. Lead Mfrs., Ltd.	—
Atlas Copco (G.B.), Ltd.	—
August's, Ltd.	36
Austin, E., & Sons, Ltd.	—
Badische Maschinenfabrik A.-G.	31
Bairds & Scottish Steel, Ltd.	—
Baker Perkins, Ltd.	37
Balbardie, Ltd.	—
Ballard, F. J., & Co., Ltd.	—
Ballinger, L. J. H., Ltd.	—
Beans Industries, Ltd.	—
Bellise & Morcom, Ltd.	—
Bennett, H. G., & Co. (Gloves), Ltd.	—
Berk, F. W., & Co., Ltd.	—
Bilston Stove & Steel Truck Co., Ltd.	44
Birkett, F. W., & Co., Ltd.	—
Birlec-Efco (Melting), Ltd.	—
Blackwell's Metallurgical Works, Ltd.	—
Boomer, Holt, Ltd.	—
Boydell, E., & Co., Ltd.	—
Bradbury, John, & Co. (Stockport), Ltd.	—
Bradley & Foster, Ltd.	15
British Acheson Electrode, Ltd.	—
British Aero Components, Ltd.	—
British Cast Iron Research Association	—
British Electrical Repairs, Ltd.	—
British Foundry Units, Ltd.	26
British Industrial Sand Ltd.	—
British Iron & Steel Federation	—
British Monorail, Ltd.	7
British Moulding Machine Co., Ltd.	1
British Oxygen Co., Ltd.	—
British Ronceray, Ltd.	5
British Shotblast & Engineering Co., Ltd.	—
Broom & Wade, Ltd.	—
Buckland Sand & Silica Co., Ltd.	—
Burn, John, & Co. (B'ham), Ltd.	45
Burnand, W. E., & Son, Ltd.	—
Canning, W., & Co., Ltd.	—
Carborundum Co., Ltd.	—
Catalin, Ltd.	3 & 43
Cawood Wharton & Co., Ltd.	50
Chapman & Smith, Ltd.	—
Chemicals & Feeds, Ltd.	—
Chetham Timber Co., Ltd.	—
Ciba (A.R.L.), Ltd.	—
City Casting & Metal Co. Ltd.	20
Clayton Crane & Hoist Co. Ltd.	—
Cleanair, Ltd.	—
Cohen, Geo. Sons & Co., Ltd.	—
Coleman-Wallwork Co. Ltd.	10
Combustion Chemicals, Ltd.	—
Constructional Engineering Co., Ltd., The	—
Controlled Heat & Air, Ltd.	44
Conveyor & Shotblast, Ltd.	—
Cooke, Bailey, Ltd.	—
Coreshooters Sales, Ltd.	—
Corrosion Ltd.	—
Cox & Danks, Ltd.	—
Crockett Lowe, Ltd.	—
Crooks, L. E.	—
Cumming, Wm., & Co., Ltd.	12
Dallow, Lambert & Co. Ltd.	—
Derby & Co., Ltd.	—
Dickson, Roy Wilson, Ltd.	—
Distillers Co., Ltd., The	19
Dowler, H. J., Engineers & Pattern Makers, Ltd.	—
Dowson & Mason, Ltd.	—
Dunford & Elliott (Sheffield), Ltd.	—
Durrans, James & Sons Ltd.	11
Dustraction, Ltd.	—
Dustuctor Co., Ltd.	14
Dyson, J. & J., Ltd.	—
Electrical Development Association	—
Electrogenerators, Ltd.	—
Elliott Bros. (London) Ltd.	—
Elliott, E., Ltd.	—
Engineering Marine Welding & Nuclear Energy Exbn.	—
Engineering Services (Manchester) Ltd.	—
Escol Products, Ltd.	20
Evans, James, & Co., Ltd.	—
Evans, Roy, M.I.B.F.	22
Evans, Stanley N., Ltd.	13
Eyre Smelting Co., Ltd.	—
F. & M. Supplies, Ltd.	579
Felco Hoists, Ltd.	—
Filter-Heat, Ltd.	—
Fischer, George, Ltd.	—
Fisher-Foundries, Ltd.	—
Fletcher Miller, Ltd.	—
Flextol Engineering Co., Ltd.	—
Fordath Engineering Co., Ltd.	2
Foseco International, Ltd.	—
Foundry Equipment, Ltd.	24 & 25
Foundry Mechanisations (Baillot), Ltd.	17
Foundry & Metallurgical Equipment Co., Ltd.	—
Foundry Plant & Machinery, Ltd.	—
Foundry Services, Ltd.	—
Foundry Suppliers, Ltd.	18
Foxall William Ltd.	—
Foxboro Yoxall, Ltd.	—
Frankiss, R. J. (Patterns) Ltd.	41
Franklin Furnace, Ltd.	—
Fringevision, Ltd.	—
Fuel & Metallurgical Processes, Ltd.	—
Fullers' Earth Union, Ltd., The	—
G.W.B. Furnaces, Ltd.	—
Gas Council	—
General Electric Co., Ltd.	21
General Refractories, Ltd.	4
Gliksten, J., & Son, Ltd.	51
Goodyear Tyre & Rubber Co., Ltd.	581
Great Lakes Carbon International, Ltd.	—
Green, E., & Son, Ltd.	—
Green, Geo., & Co.	45
Gregory, J. G., & Sons, Ltd.	—
Griffiths, A. E. (Smethwick), Ltd.	—
Guest, Keen Iron & Steel Works	29
Guyson Industrial Equipment Ltd.	49
Harborough Construction Co., Ltd.	—
Hargraves Bros. (Manchester), Ltd.	46
Harris & Pearson, Ltd.	—
Harvey & Longstaffe, Ltd.	—
Harvey, J. J. & Pressurecast, Ltd.	—
Hedin, Ltd.	50
Heneage Metals, Ltd.	—
Hepburn Conveyor Co., Ltd.	—
Heywood, S. H., & Co., Ltd.	—
High Speed Steel Alloys, Ltd.	—
Hills (West Bromwich), Ltd.	51
Holman Bros., Ltd	—
Holmes, W. C., & Co., Ltd.	—
Holroyd & Hall, Ltd.	—
Hooker W. J., Ltd.	—
Hunt, F., L., Ltd.	—
I.C.I. (Billington Division), Ltd.	—
I.C.I. (Plastics Division), Ltd.	—
Ilford, Ltd.	—
Incandescent Heat Co., Ltd.	—
Ingersoll-Rand Co., Ltd.	—
Interplas	—
Jackman, J. W., & Co., Ltd.	—
Jacks, Wm., & Co., Ltd.	583
Keith Blackman, Ltd.	—
L.M.S. Products, Ltd.	—
Lafarge Aluminous Cement Co., Ltd.	585
Laidlaw, Drew & Co., Ltd.	—
Lazarus, Leopold, Ltd.	—
Leicester Lovell & Co., Ltd.	—
Levy, B., & Co. (Patterns), Ltd.	42
Lones, Joseph, Laboratories	—
Lord, E. S., Ltd.	—
Luke & Spencer, Ltd.	—
Macnab & Co., Ltd.	48
Major, Robinson & Co., Ltd.	50
Mansfield Standard Sand Co., Ltd.	32
Marco Conveyor & Engineering Co., Ltd.	27
Mathison, John, Ltd.	—
Matthews & Yates, Ltd.	—
May, J. H., Ltd.	42
Mead McLean & Co., Ltd.	—
Metalectric Furnaces, Ltd.	—
Metalline Cement Co., The	—
Metals & Equipment (Wolverhampton), Ltd.	—
Midgley & Son, Ltd.	—
Midland Monolithic Furnace Lining Co., Ltd.	46
Mine Safety Appliances, Ltd.	—
Modern Furnaces & Stoves, Ltd.	—
Molineux Foundry Equipment, Ltd.	—
Monometer Manufacturing Co., Ltd.	—
Morgan Crucible Co., Ltd.	—
Morris, B. O., Ltd.	—
Morris, H., Ltd.	—
Muir, Murray & Co., Ltd.	—
Newton Collins, Ltd.	—
Newman Hender & Co., Ltd.	—
Nicholl & Wood, Ltd.	—
Norris Equipment & Construction, Ltd.	—
North Derbyshire Metal Products Ltd.	—
Norton Grinding Wheel Company, Ltd.	—
Ormerod, R. E., Ltd.	—
Orthos, Ltd.	—
Palmer Aero Products, Ltd.	46
Parish, J., & Co., Ltd.	—
Park & Paterson, Ltd.	—
Parker Mitchell Engineering Co., Ltd.	49
Passe, J. F., & Co.	—
Paterson Hughes Engineering Co., Ltd.	—
Patterncrafts, Ltd.	—
Pearson, E. J. & J., Ltd.	—
Peco Machinery Sales, Ltd.	—
Perry, G., & Sons, Ltd.	—
Phillips, J. W., & C. J., Ltd.	47
Pickard, W., & Co., Ltd.	—
Pickford, Holland, Ltd.	47
Platt Metals, Ltd.	—
Pneulec, Ltd.	—
Polygram Castings Co., Ltd.	—
Precision Presswork Co., Ltd.	—
Price, J. T., & Co., Ltd.	54
Production Chemicals (Rochdale), Ltd.	—
Purimachos, Ltd.	—
Rapid Magnetic, Ltd.	—
Reavell & Co., Ltd.	—
Refined Iron Co. (Darwen), Ltd.	—
Reid, Wm., & Co.	—
Richards Structural Steel Co., Ltd.	—
Richardson Eng'g., Ltd.	54
Richardsons Moss Litter Co., Ltd.	9
Richardsons, R. J. & Sons Ltd.	—
Ridsdale & Co., Ltd.	54
Robson Refractories, Ltd.	—
Roper, E. A., & Co., Ltd.	—
Rowland, F. E., & Co., Ltd.	—
Rubery Owen & Co., Ltd.	—
Rule & Moffat	—
Rustless Iron Co., Ltd.	—
Safety Products, Ltd.	32
Salter, Geo., & Co., Ltd.	—
Schieldrop & Co., Ltd.	30
St. George's Engineers, Ltd.	22
Selber, J., Equipment Co., Ltd.	48
Sheffield Smelting Co., Ltd.	—
Shell Chemical Co., Ltd.	—
Sheppard & Co., Ltd.	—
Sinex Eng'g. Co., Ltd.	—
Sintokogio, Ltd.	—
Sklenar Furnaces, Ltd.	—
Smedley Bros., Ltd.	—
Smeeton, J. A., Ltd.	—
Smith, A., & Co.	—
Smith, A. (S. & B. Foundry Sands), Ltd.	—
Smith, John (Keighley), Ltd.	—
Smiths Motor Accessories, Ltd.	—
Spencer & Halstead, Ltd.	—
Spermolin, Ltd.	—
Stansby, W., & Co., Ltd.	42
Stanton Ironworks Co., Ltd., The	—
Staveley Iron & Chemical Co., Ltd.	—
Steels Engineering Installations	—
Stein, John G., & Co., Ltd.	—
Stephens, Wm., & Sons, Ltd.	—
Sterling Foundry Specialties, Ltd.	23 & 34
Sternol, Ltd.	6
Suffolk Iron Foundry (1920). Ltd.	49
Tallis, E., & Sons, Ltd.	8
Taylor, J. (Syston), Ltd.	—
Thomas, G. & R., Ltd.	—
Thompson, John, Instrument Co., Ltd.	—
Thomson & McIntyre	42
Thor Tools, Ltd.	—
Tilghman's, Ltd.	16
Union Carbide, Ltd.	—
Unit Engineering Co.	—
United Fireclay Products, Ltd.	—
United States Metallic Packing Co., Ltd.	—
Verrolec, Ltd.	—
Victor Products, Ltd.	—
Wagner Heinrich, Maschinenfabrik	—
Wal-Met Alloys Co.	—
Walker, I. & I., Ltd.	—
Walsh Bros.	—
Ward, Thos. W., Ltd.	—
Warner & Co., Ltd.	53
Warrington Red Moulding Sand Co.	—
Watsons (Metallurgists), Ltd.	—
West Midland Refining Co., Ltd.	—
Whitecross Co., Ltd.	—
Wild-Barfield Electric Furnaces, Ltd.	—
Wilkinson Rubber-Linatex Co., Ltd.	—
Wilson Crucible Co., Ltd.	—
Witham, L. A., & Co.	46
Woking Pattern Works, Ltd.	—
Woodward Bros. & Copelin, Ltd.	—

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Modern carving of a sow and litter in All Saints Church, Beighton. Photograph by Ruth Meyler & F. C. Sillar

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EST. 1902

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VOL. 110
No. 2317

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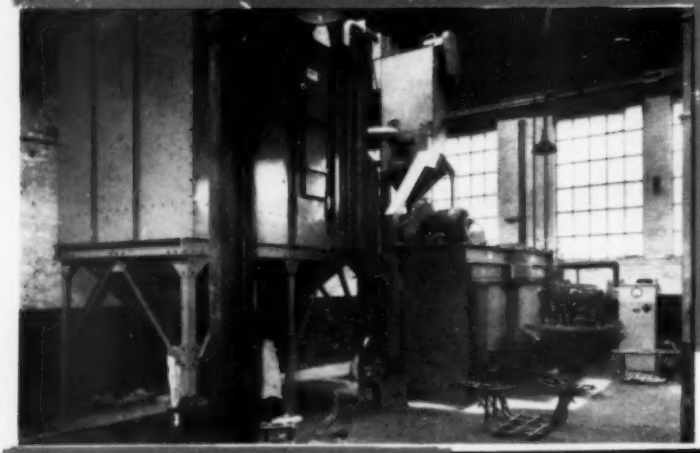

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